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By arrangement between NASA and the Smithsonian Science Information Exchange (SSIE), a separate section of information on aerospace-related *On-Going Research Projects* is inserted into each issue of *STAR*. The insert presents titles of active NASA grants and university contracts, summary portions of recently updated *NASA Research and Technology Objectives and Plans (RTOPs)*, and notices of non-NASA research projects that were funded in the most recent or current fiscal year. The latter are selected by SSIE. The project announcements in the insert are arranged by *STAR* divisions but are otherwise entirely separate from *STAR*. They are not indexed nor machine-searchable by NASA. Current and retrospective searches are available from SSIE, 1730 M Street, N.W., Washington, D.C. 20036.

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AERONAUTICS

Includes aeronautics (general); aerodynamics; air transportation and safety; aircraft communications and navigation; aircraft design, testing and performance; aircraft instrumentation; aircraft propulsion and power; aircraft stability and control; and research and support facilities (air).

For related information see also *Astronautics*.

Each major division is further divided into as many as nine specific categories, which are identified by category numbers.

Abstracts in *STAR* are grouped by specific category, the categories appearing in sequential order. Category breaks in the abstract section are identified by the category number and title, and a scope note. Cross-references to other categories are provided as appropriate. For example:

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

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Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

03 AIR TRANSPORTATION AND SAFETY 1797

Includes passenger and cargo air transport operations; and aircraft accidents.

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04 AIRCRAFT COMMUNICATIONS AND NAVIGATION 1798

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

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05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE 1799

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

06 AIRCRAFT INSTRUMENTATION 1800

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

07 AIRCRAFT PROPULSION AND POWER 1801

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

08 AIRCRAFT STABILITY AND CONTROL 1803

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

09 RESEARCH AND SUPPORT FACILITIES (AIR) 1804

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space)*.

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

For related information see also *Aeronautics*.

12 ASTRONAUTICS (GENERAL) 1806

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13 ASTRODYNAMICS 1806

Includes powered and free-flight trajectories; and orbit and launching dynamics.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE) N.A.

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air)*.

15 LAUNCH VEHICLES AND SPACE VEHICLES 1807

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

16 SPACE TRANSPORTATION 1808

Includes passenger and cargo space transportation, e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING N.A.

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE 1809

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

19 SPACECRAFT INSTRUMENTATION 1809

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

20 SPACECRAFT PROPULSION AND POWER 1810

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion*.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

23 CHEMISTRY AND MATERIALS (GENERAL) 1810

Includes biochemistry and organic chemistry.

24 COMPOSITE MATERIALS 1811

Includes laminates.

25 INORGANIC AND PHYSICAL CHEMISTRY 1813

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

26 METALLIC MATERIALS 1818

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

27 NONMETALLIC MATERIALS 1822

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

28 PROPELLANTS AND FUELS 1825

Includes rocket propellants, igniters, and oxidizers; storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion*.

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

For related information see also *Physics*.

31 ENGINEERING (GENERAL) 1827

Includes vacuum technology; control engineering; display engineering; and cryogenics.

32 COMMUNICATIONS 1832

Includes land and global communications; communications theory; and optical communications.

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33 ELECTRONICS AND ELECTRICAL ENGINEERING 1837

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34 FLUID MECHANICS AND HEAT TRANSFER 1841

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

35 INSTRUMENTATION AND PHOTOGRAPHY 1845

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation* and *19 Spacecraft Instrumentation*.

36 LASERS AND MASERS 1847

Includes parametric amplifiers.

37 MECHANICAL ENGINEERING 1850

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

38 QUALITY ASSURANCE AND RELIABILITY 1852

Includes product sampling procedures and techniques; and quality control.

39 STRUCTURAL MECHANICS 1853

Includes structural element design and weight analysis; fatigue; and thermal stress.

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GEOSCIENCES

Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

For related information see also *Space Sciences*.

42 GEOSCIENCES (GENERAL) 1858

43 EARTH RESOURCES 1858
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44 ENERGY PRODUCTION AND CONVERSION 1865
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46 GEOPHYSICS 1883
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47 METEOROLOGY AND CLIMATOLOGY 1886
Includes weather forecasting and modification.

48 OCEANOGRAPHY 1890
Includes biological, dynamic and physical oceanography; and marine resources.

LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.

51 LIFE SCIENCES (GENERAL) 1891
Includes genetics.

52 AEROSPACE MEDICINE 1891
Includes physiological factors; biological effects of radiation; and weightlessness.

53 BEHAVIORAL SCIENCES 1893
Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT 1894
Includes human engineering; biotechnology; and space suits and protective clothing.

55 PLANETARY BIOLOGY N.A.
Includes exobiology; and extraterrestrial life.

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL) N.A.

60 COMPUTER OPERATIONS AND HARDWARE 1894
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61 COMPUTER PROGRAMMING AND SOFTWARE 1896
Includes computer programs, routines, and algorithms.

62 COMPUTER SYSTEMS N.A.
Includes computer networks.

63 CYBERNETICS 1900
Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support*.

64 NUMERICAL ANALYSIS 1901
Includes iteration, difference equations, and numerical approximation.

65 STATISTICS AND PROBABILITY 1908
Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

66 SYSTEMS ANALYSIS 1910
Includes mathematical modeling; network analysis; and operations research.

67 THEORETICAL MATHEMATICS 1911
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Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.
For related information see also *Engineering*.

70 PHYSICS (GENERAL) 1911
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71 ACOUSTICS 1911
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72 ATOMIC AND MOLECULAR PHYSICS 1913
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75 PLASMA PHYSICS 1916
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76 SOLID-STATE PHYSICS 1919
Includes superconductivity.
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77 THERMODYNAMICS AND STATISTICAL PHYSICS 1921
Includes quantum mechanics; and Bose and Fermi statistics.
For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

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Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

80 SOCIAL SCIENCES (GENERAL) N.A.
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81 ADMINISTRATION AND MANAGEMENT 1921
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82 DOCUMENTATION AND INFORMATION SCIENCE 1922
Includes information storage and retrieval technology; micrography; and library science.
For computer documentation see *61 Computer Programming and Software.*

83 ECONOMICS AND COST ANALYSIS N.A.
Includes cost effectiveness studies.

84 LAW AND POLITICAL SCIENCE 1923
Includes space law; international law; international cooperation; and patent policy.

85 URBAN TECHNOLOGY AND TRANSPORTATION 1923
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences.*

88 SPACE SCIENCES (GENERAL) N.A.

89 ASTRONOMY 1924
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 1925
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 1925
Includes planetology; and manned and unmanned flights.
For spacecraft design see *18 Spacecraft Design, Testing and Performance.* For space stations see *15 Launch Vehicles and Space Vehicles.*

92 SOLAR PHYSICS 1926
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 1927
Includes cosmic radiation; and inner and outer earth's radiation belts.
For biological effects of radiation see *52 Aerospace Medicine.* For theory see *73 Nuclear and High-Energy Physics.*

GENERAL

99 GENERAL 1927

Note: N.A. means that no abstracts were assigned to this category for this issue.

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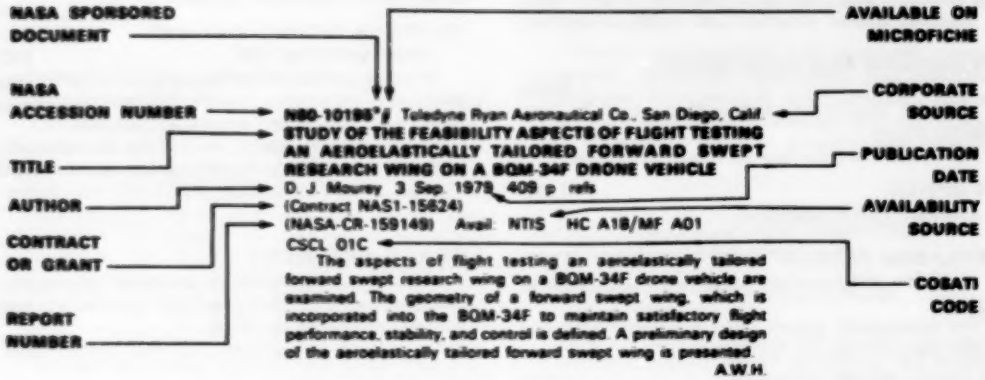
TYPICAL CITATION AND ABSTRACT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NASA ACCESSION NUMBER
N80-10188*# Teledyne Ryan Aeronautical Co., San Diego, Calif.
CORPORATE SOURCE
TITLE
STUDY OF THE FEASIBILITY ASPECTS OF FLIGHT TESTING AN AEROELASTICALLY TAILORED FORWARD SWEPT RESEARCH WING ON A BQM-34F DRONE VEHICLE
PUBLICATION DATE
AUTHOR
D. J. Mourey 3 Sep 1979 409 p refs
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REPORT NUMBER
The aspects of flight testing an aeroelastically tailored forward swept research wing on a BQM-34F drone vehicle are examined. The geometry of a forward swept wing, which is incorporated into the BQM-34F to maintain satisfactory flight performance, stability, and control is defined. A preliminary design of the aeroelastically tailored forward swept wing is presented.
A.W.H.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects - not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, CRASHWORTHY PASSENGER (MILITARY) SEAT

R. Mazelsky, A R A Co., *2017 W. Garvey Ave., West Covina, California* 91791 (DN081084; N62269-78-C-0251)

To develop a military passenger seat offering the safety, comfort, and protective features which 'state-of-the-art' crashworthy seat technology has to offer. This contract supports work unit ZA601, Agency Accession No. DN 681080.

Development will involve three tasks: Task I will comprise the design phase; Task II will include the fabrication of prototypes and the static and dynamic test and evaluation phase; Task III will evaluate advanced prototypes under dynamic crash simulation tests.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0002, CALIFORNIA POLYTECHNIC GRADUATE STUDENT PROGRAM

D.R. Sandlin, California State University & Colleges, California Polytechnic State University, School of Engineering & Technology, Dept. of Aeronautical Engineering, *San Luis Obispo, California* 93407 (NCC 4-1)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Hugh L. Dryden Flight Research Center

1.0003, COMPUTER CIRCLED OPTIMIZATION IN SELECTION OF OPTIMAL DESIGN PARAMETERS OF HELICOPTER ROTORS

A.G. Liniecki, California State University & Colleges, San Jose State University, School of Engineering, Dept. of Mechanical Engineering, *Washington Sq., San Jose, California* 95192 (NCA 2-675001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0004, FLOW ANALYSIS OVER AN ADVANCING ROTOR BLADE

K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-42)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0005, THE RESEARCH AND TRAINING ACTIVITIES FOR THE JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS

K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-55)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0006, JOINT INSTITUTE FOR AERONAUTICS AND ACOUSTICS - STUDY OF TRAILING EDGE FLOWS AT HIGH REYNOLDS NUMBER

K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-59)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0007, BASIC STUDIES OF MULTIPLE JETS AND WALL JETS

K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (DF056190; F49620-79-C-0189)

AF function - advanced aerospace vehicles. Deficiency -insufficient understanding exists of the physical features of complex flow fields associated with free and unconfined multiple jets and wall jets. Objective - to advance the state of knowledge regarding multiple interacting jets and wall jets. Detailed flow field surveys will be performed, and a determination will be made of the dependence of these flows on key flow and geometric parameters. How work contributes - the successful design and development of future powered lift aircraft will require increased knowledge regarding the interactive flow fields of multiple jets and of wall jets, which are usually present in such vehicles. Basic knowledge of relevant jet flow fields will be acquired, which is necessary for devising suitable prediction techniques.

For a range of geometric configurations and initial flow field conditions, detailed experimental investigations will be conducted into the mean, periodic, and random structure of the flow fields of multiple jets and wall jets. Consideration will be given to spacial and temporal variations of flow quantities, spectral and correlation characteristics, and mean and fluctuating pressures on the solid surfaces present.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0008, DIGITAL CONTROL SYSTEM SYNTHESIS USING MULTIPLE ORDER SAMPLING

R.F. Whitbeck, Systems Technology Inc., *13766 S. Hawthorne Blvd., Hawthorne, California* 90250 (DF143430; F33615-79-C-3601)

This work unit supports TP03, Flight Control Technology, and specific goal FG02B, Flight Control System Design Technique. Many current digital design procedures attempt only to approach the characteristics of existing analog designs. The present practice is to first develop a good analog design and then emulate it digitally using single-rate sampling. No explicit methodology exists which can exploit the unique characteristics of multi-rate or multiple order digital computation/filtering. The

overall objective of the research effort is to develop a multi-rate/multiple order theory for the design of closed-loop digital control systems with characteristics and attributes that are either difficult or impossible to attain with analog or single-rate controllers. The key idea in this new multi-rate/multiple order design methodology is to use the logic of the computer to take a scalar continuous output signal, sample it at a relatively high rate, and then sort out the various samples into a vector of pseudo-measurements. The potential of such a scheme is significant, since it offers, among other things, the possibility of using fewer sensors, the potential for providing gracefully degrading system performance in the face of sensor failure, and the possibility of being able to do away with aliasing filters. This research effort will provide an explicit design methodology for future military aircraft flight controls that will insure optimum use of digital techniques, considering both cost and performance, and thus lead to the best practical flight control system.

An important facet of this effort is to develop simple and effective descriptions for multi-rate and multiple order sampling in the vector switch decomposition format. The vector switch decomposition model provides a straightforward way to generate a vector of pseudo-measurements from a scalar signal. The continuous frequency response theory for digitally controlled systems will be applied to the multi-rate/multiple order sampling architectures in order to investigate their spectral characteristics and to catalog their useful filtering properties. Extension of the frequency domain analysis techniques will be accomplished to accomodate multi-rate/multiple order sampling. This will bring the characteristics of new design methodology into better focus and integrate it with existing control system design knowledge.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0009, RESEARCH PROGRAM IN FLIGHT DYNAMICS IN THE JOINT INSTITUTE FOR ADVANCEMENT OF FLIGHT SCIENCES AT THE NASA LANGLEY RESEARCH CENTER

H. Lielowitz, George Washington University, School of Engineering & Applied Sciences, Dept. of Civil Mechanical & Environmental Engineering, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NCC 1-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0010, THE INVESTIGATION OF THE FLOW ABOUT GENERAL FUSELAGE SHAPES AT HIGH ANGLES OF ATTACK

M.H. Clarkson, State University System of Florida, University of Florida, School of Engineering, Dept. of Engineering Sciences, *220 Black Hall, Gainesville, Florida* 32611 (NCC 2-23)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0011, RESEARCH IN ENGINE NOZZLE DESIGN FOR A HYPERSONIC FLIGHT VEHICLE

G.W. Zumwalt, Wichita State University, School of Engineering, Dept. of Aeronautical Engineering, *1845 Fairmont N., Wichita, Kansas* 67208 (NCC 1-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

1.0012, IDENTIFICATION AND ADAPTIVE CONTROL OF HELICOPTER SYSTEMS

P.E. Caines, Harvard University, Cambridge Campus, School of Arts & Sciences, Dept. of Mathematics, *Cambridge Station, Cambridge, Massachusetts* 02138 (NCC 2-39)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0013, TURBULENT BOUNDARY LAYER STRUCTURE AND DRAG REDUCTION

M.T. Landahl, Massachusetts Inst. of Technology, School of Engineering, Dept. of Aeronautics & Astronautics, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF053960; AFOSR-79-0006)

AF function - advanced aerospace vehicles. Opportunity - gain further understanding of unsteady boundary layers. Objective -investigate the unsteady boundary layer phenomena induced on a fixed, stationary, two-dimensional airfoil. How work contributes - better knowledge of the unsteady mechanisms of a turbulent boundary layer will contribute understanding of flutter, buffeting and stall flutter, all common problems for airfoils used for helicopter blades, rotating machinery blades and fixed wing aircraft lifting surfaces. The data obtained from this effort will be directly applicable to the design of future aerospace vehicles.

The unsteady local flow around a well documented airfoil (NACA 0012) will be obtained in a steady flow field using a rotating elliptical cylinder near the airfoil trailing edge. Unsteady pressure measurements, unsteady local skin friction, tangential velocity components and other boundary layer parameter measurements will be taken and analyzed with respect to the phase angles of the unsteady velocities relative to that of the excitation. The airfoil will be held stationary at all times.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

1.0014, THE EFFECT OF TURBULENT BOUNDARY LAYER ON TRANSONIC FLOWS

S.C. Lee, University of Missouri, Rolla Campus, School of Engineering, Dept. of Aerospace Engineering, *Rolla, Missouri* 65401 (NCA 2-450001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0015, AIRBORNE SIMULATION AND RESEARCH INVESTIGATIONS

P.A. Reynolds, Calspan Corp., *1422 Genesses Ave., P.O. Box 235, Buffalo, New York* 14221 (DF142120; F33615-78-C-3602)

Engineering simulation is a cost-effective design tool for supporting advanced weapon systems development. In-flight simulation using variable stability airplanes provides the advantages of actual flight, visual, and motion cues in evaluating design trade-offs. The NT-33 and NC-131H variable stability airplanes will be used to conduct research programs to investigate flight control system problems and the integration of other subsystems with flight control. The systematic integration of the control function with other weapon systems functions such as fire control and control displays will result in new airplanes which can provide greater flexibility and mission effectiveness.

The NT33A and the TIFS NC-131H variable stability aircraft will be used to look at riding and flying qualities, simulated control systems, actual displays, cockpit controllers, actual control system hardware and the interaction between these factors and other airplane subsystems. Flight training will also be included for pre-first flights of new aircraft as well as test pilot schools indoctrinations. Details of each investigation or training program will be outlined at a planning meeting between the contractor, AF Flight Dynamics Laboratory and the requiring agency personnel prior to each investigation. These details will be documented by a test plan prior to flight testing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0016, DIGITAL FLIGHT CONTROL CRITERIA DEVELOPMENT

W. Muller, Grumman Aerospace Corp., *S. Oyster Bay Rd., Bethpage, New York* 11714 (DN081107; N62269-79-C-0430)

To update, combine, coordinate, and develop criteria applicable to advanced flight control systems and new flight modes for new aircraft development. This contract supports work unit ZA601, Agency Accession No. DN681080.

Survey advanced aircraft requirements; evaluate integration aspects; evaluate new flight modes criteria; and identify unique criteria for V/STOL aircraft.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0017, AN INTRODUCTORY STUDY OF THE H-FORCE ROTOR
H.R. Velkoff, Ohio State University, Columbus Campus, School of Engineering, Dept. of Mechanical Engineering, *190 N. Oval Dr., Columbus, Ohio* 43210 (NCA 2-565001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0018, SYMBOLOGY VERIFICATION
J.M. Reising, U.S. Dept. of Defense, Air Force, Flight Dynamics Lab., *Wright Patterson A.F.B., Dayton, Ohio* 45433 (DF141720)

The inability of pilots to distinguish certain display symbols in selected symbology sets has become a matter of growing concern to USAF control display designers. As a part of the Digital Avionics Information System (DAIS) Experiment, this problem will be addressed by determining through objective analysis the error rates, search times and flying performance of subject pilots in a cockpit similar to the Digital Flight Control System (DFCS) cockpit. Display symbols which confuse pilot subjects will be modified using an algorithm to determine pilots' useability/acceptability of various display options.

A literature search will be conducted on the displays chosen for investigation. Possible alternatives will be programmed and objective performance and subjective attitude of pilot subjects will be evaluated. This evaluation will allow FGR to select the best display and symbol set. The results of this experiment will be documented in a technical report. Recommendation for an improved symbol set will be submitted to MIL-STD-884C.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, BASIC STUDIES OF A RECTANGULAR JET IMPINGEMENT ON THE SURFACE
A. Krothapalli, University of Oklahoma, Norman Campus, Graduate School, *660 Parrington Oval, Room 101, Norman, Oklahoma* 73069 (NCA 2-580001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

1.0020, INVESTIGATION OF BUOYANT AIR VEHICLES FOR STRATEGIC AND TACTICAL PLATFORM MISSIONS
T.E. Bebout, Delex Systems Inc., *8150 Leesburg Pike, Suite 700, Vienna, Virginia* 22180 (DN081130; N62269-79-C-0269)

To investigate the potential application of buoyant and semi-buoyant air vehicles for future strategic high value targets and tactical platform mission requirements. The contract supports work unit DH828, Agency Accession No. DN081061.

A systems approach will be undertaken to achieve the above objective. Principal areas of the study will be the performance of mission analysis, including trade-offs and operational effectiveness, the generation of vehicle parametrics, vulnerability, environmental effects, and various scenarios of operations will be analyzed.

SUPPORTED BY U.S. Dept. of Defense, Naval Air Development Center, Aircraft & Crew Systems Tech Directorate

1.0021, HEAD-UP DISPLAY FOR C-130 LAPES OPERATIONS
F.K. Brem, Sundstrand Data Control Inc., *Overlake Industrial Park, Redmond, Washington* 98052 (DF142990; F33615-78-C-3618)

This work assists the Military Airlift Command in attaining a safe and effective cargo delivery capability. In recent years the experience level of C-130 pilots has decreased causing safety problems in low altitude parachute extraction system (LAPES) operations. The objective is to evaluate a Head-Up display as a solution to the problem of safely carrying out LAPES operations in the C-130 aircraft. It is believed that a Head-Up display will aid inexperienced pilots in precisely controlling the C-130 in the vertical approach pattern of the LAPES operation. If a Head-Up display can aid the C-130 pilot in precisely controlling his aircraft, the Air Force can save resources in the training of LAPES pilots (now in critical supply), and in reducing the number of accidents attributed to inexperienced pilots.

The LAPES HUD developed by SUNDSTRAND Data Control will be installed in an operational C-130 LAPES-configured aircraft. It will be evaluated during operational training missions to determine its potential usefulness as a pilot's aid.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0022, REDUCTION OF AERODYNAMIC DRAG
J.E. Field, University of Cambridge, *Hills Rd., Cambridge, England, United Kingdom* (DF054520; AFOSR-79-0057)

AF function - advanced aerospace vehicles. Opportunity - to provide understanding of the effect of small amounts of radiation on the molecular structure of air and other gases. Objective - to study the mechanisms of viscosity by reduction at the molecular level of air and various other gases when bombarded with low level radioactive emissions. How work contributes - this effort will research the control of viscosity by radiation. If successful, it could provide an effective method for control of aerodynamic drag and a possible method for retarding the transition to turbulence. The author postulates that this method is similar to the effect of long-chain polymers in liquids.

A flow channel will be used to determine the effect of alpha and beta bombardment of a surface on its skin friction drag. First a friction gauge will be constructed on the channel wall, later the drag on suspended shapes will be attempted. Gaseous systems of air, nitrogen and oxygen with varying amounts of humidity will be used. In addition to the friction balance, hot wire and magnetic probe measurements will be taken.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

ASTRONAUTICS

Includes Astronautics (general); Astrodynamics; Ground Support Systems and Facilities (space); Launch Vehicles and Space Vehicles; Space Transportation; Spacecraft Communications; Command and Tracking; Spacecraft Design, Testing, and Performance; Spacecraft Instrumentation; and Spacecraft Propulsion and Power. For Related Information See Also Aeronautics.

2.0001, NASA-AMES/STANFORD JOINT INSTITUTE FOR AERONAUTICS & ACOUSTICS - SHUTTLE INFRARED TELESCOPE POINTING CONTROL SYSTEM
J.D. Powell, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-29)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0002, TECHNOLOGY RESEARCH FOR STRAPDOWN INERTIAL EXPERIMENTS
R.B. Jenkins, University of Southern Colorado, School of Applied Science & Engineering Technology, Dept. of Electrical Engineering Technology, *2200 Bonforte Blvd., Pueblo, Colorado* 81001 (NCC 2-41)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

2.0003, APPLICATION OF PHOTO-ORTHOTROPIC ELASTICITY TO PLANE PROBLEMS IN COMPOSITES
R. Prabhakaran, Old Dominion University, Graduate School, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NCC 1-26)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, PLASMA SYNTHESIS OF MODEL METEORITIC ORGANIC MATTER
K.G. Donohoe, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-58)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0002, CHARACTERIZATION AND DEGRADATION STUDIES ON AROMATIC POLYAMIDES, POLYESTERS AND COMPOSITE RESINS
A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0003, HEAT RELEASE STUDIES FOR AIRCRAFT MATERIALS
A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-56)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0004, NEW ELASTOMERS FOR IMPROVED AIRCRAFT TIRES
A.C. Ling, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-57)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0005, MINERAL SEPARATION SYSTEMS
L.A. Spitze, California State University & Colleges, San Jose State University, School of Science, Dept. of Chemistry, *Washington Sq., San Jose, California* 95192 (NCC 2-53)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0006, SEMICLASSICAL APPROACHES TO DYNAMICS OF MOLECULES
E.J. Heller, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Chemistry, *405 Hilgard Ave., Los Angeles, California* 90024 (CHE77-13305 A01)

This project will carry out a systematic investigation of new semiclassical techniques for certain molecular processes and properties. The previous form of Miller-Marcus semiclassical theory will be generalized to include wave pocket amplitudes, with the benefit that many of the well-known and otherwise unavoidable numerical difficulties and inaccuracies of that approach are eliminated or mitigated. The benefits of this extended approach include elimination of root or stationary trajectory searches, increased accuracy for 'primitive' semiclassical results, convenient numerical uniformization at various levels up to the ab initio, and a practical way of obtaining bound states (for multidimensional non-separable systems), suitable for use in spectroscopy or in other semiclassical calculations. The investigators will develop a coherent, unified attack on the problem of semiclassical methods of interest to chemical dynamics. A series of numerical tests and applications of increasing complexity will be carried out.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0007, SYNTHESIS OF ORGANIC COMPOUNDS UNDER PRIMITIVE EARTH CONDITIONS
S.L. Miller, University of California, San Diego Campus, Graduate School, Dept. of Chemistry, *P.O. Box 109, La Jolla, California* 92037 (CHE76-16779 A02)

Amino acids can be synthesized by the action of electric discharges and other sources of energy on a mixture of methane, ammonia, water and hydrogen. These gases were probably the components of the atmosphere of the primitive earth. Purines can be synthesized from hydrogen cyanide, and similar types of reactions can synthesize other components of present living organisms. Prebiotic reactions will be studied for the synthesis of the basic amino acids, tryptophan, diaminopimelic acid, water soluble vitamins, porphyrins, and diamines such as ethylene diamine and putrescine. The additions of ammonia and cyanide to acrylonitrile and acrolein will be investigated since these are major prebiotic compounds. Polymers of hydroxyacids, which could have been produced on the primitive earth, will be investigated for their ability to polymerize amino acids, nucleosides and activate phosphate. The prebiological synthetic reactions will be investigated paying particular attention to the plausibility of such reactions on the primitive earth. This work is a continuation of that currently supported by Foundation grant GP-36294.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0008, CLAY CATALYSIS OF PREBIOTIC POLYMERIZATIONS - POSSIBLE ROLES AND MECHANISMS OF ACTION OF METAL IONS
M.A. Sweeney, University of Santa Clara, School of Science, Dept. of Chemistry, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685005)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0009, PEPTIDE CATALYSIS OF POLYNUCLEOTIDE-TEMPLATED AMINO ACID CONDENSATION OF FLUCTUATING CLAY SURFACES
D.H. White, University of Santa Clara, School of Science, Dept. of Chemistry, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685006)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

3.0010, AN INVESTIGATION OF ATMOSPHERIC S, N, AND CL COMPOUNDS IN THE TROPOSPHERE
B.J. Huebert, Colorado College, Graduate School, Dept. of Chemistry, *Colorado Springs, Colorado* 80903 (ATM77-11877 A02)

The objective of this research is to continue measurements of the tropospheric concentrations of HCl, HNO3, SO2, and particulate Cl ion, SO4 ions, and NH4 ions. The study will be conducted over the Pacific and North Atlantic oceans and many areas of an integrated measurement program aimed at determining atmospheric concentrations of trace gases and aerosols from a Lockheed Electra research aircraft. The data gathered will be used to: (1) improve understanding of the global budgets of S, N, and Cl compounds; (2) permit a computation of the exchange rates of trace gases and particles between the troposphere and stratosphere; (3) provide a basis for calculations of the extent to which HCl, HNO3, and SO2 contribute to atmospheric acidity; and (4) provide information on reaction mechanisms in clean and polluted air. Measurement techniques include collection of particles and acidic gases from large-volume air

samples followed with chemical analysis by fluorescence quenching, autoanalyzer, and ion chromatographic techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

3.0011, MAGNETIC CIRCULAR DICHROISM STUDIES OF MATRIX ISOLATED DIATOMIC OXIDES

M.T. Vala, State University System of Florida, University of Florida. School of Arts & Sciences, Dept. of Chemistry, *208 Tigert Hall, Gainesville, Florida* 32601 (CHE77-00988 A01)

Experimental research on the spectroscopy of selected diatomic oxides will be performed by Professor Martin Vala. In particular, he will investigate the alkaline earth oxides (MgO, CaO, SrO, and BaO), the Group IV B transition metal oxides (TiO, ZrO, and HfO), and the rare earth oxides (CeO, NdO, and SmO). The matrix-isolated magnetic circular dichroism and absorption spectroscopy of these diatomics will be investigated to confirm, where assigned, and to establish, where unknown, the excited electronic state assignments; additional information on excited and ground state magnetic moments and spin-orbit interactions will be sought. The study of dye laser-induced emission and magnetic-induced circularly polarized emission spectroscopy, lifetimes, and relative quantum yields of these species will also be studied by Professor Vala in order to gain information on the pathways of radiative and nonradiative decay between excited electronic, vibrational, and ground electronic states.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0012, THE RELATIONSHIP BETWEEN STRUCTURAL AND SUPERCONDUCTING TRANSITIONS IN VANADIUM 3 GALLIUM AND VANADIUM 3 SILICON

I.L. Spain, University of Maryland, College Park Campus, School of Engineering, Dept. of Chemical Engineering, *College Park, Maryland* 20742 (DMR76-09065)

The compounds vanadium 3 silicon and vanadium 3 gallium are superconductors with high superconducting transition temperatures (17.1 and 16.5 degrees K, respectively). These and other materials of the same type, known as A-15 superconductors, have great potential in technological applications such as windings for motors and generators, and loasless transmission lines. Their superconducting properties are believed to be associated with lattice instabilities as well as electronic anomalies. The lattice instability manifests itself as a reduction in an elastic constant as the temperature is lowered (mode-softening behavior), and as it tends to a zero-value the lattice distorts from its cubic form to a tetragonal form by a martensitic transformation.

The present research will study the properties of the mode-softening behavior, the martensitic transformation and other structural anomalies and attempt to relate them to the superconducting behavior. High pressure techniques will be used to vary the interatomic behavior and high magnetic fields to modify the electronic characteristics. In order to study the above problems, unique facilities will be used. Small, low temperature versions of the diamond-anvil high pressure cell will be employed, allowing structural information to be gained on both polycrystalline and single crystal specimens. In addition, information about electrical and magnetic properties will be obtained.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

3.0013, LITHIUM INORGANIC ELECTROLYTE BATTERY INVESTIGATION

M. Slavin, GTE Sylvania Inc., *Needham Heights, Massachusetts* 02194 (DF461350; F33615-77-C-2021)

Provide technology for safe, lithium inorganic electrolyte batteries which meet the performance requirements of life support, spacecraft, and missile silo applications.

Define the conditions and causes of lithium inorganic electrolyte battery explosions. Eliminate the above causes or establish a range of parameters under which safe operation can be achieved. Establish shelf life for both anode and cathode limited cells. Investigate sulfuryl chloride in addition to thionyl chloride as an electrolyte solvent/reactant.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0014, ROLE OF COUPLING AGENTS IN METAL-POLYMER ADHESION

C.S. Sung, Massachusetts Inst. of Technology, School of Engineering, Dept. of Materials Science & Engineering, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (DF055160; F49620-79-C-0085)

AF function - the incorporation of composite materials into AF aircraft has been increasingly desirable due to their lightweight and reduced manufacturing costs. Deficiency - the adhesive interface in a compositely bonded structure is susceptible to failure under environmental attack. Objective - to better understand the role of coupling agents in promoting environmentally resistant metal-polymer adhesive bonds. How work contributes - by obtaining a basic understanding of the role of coupling agents on adhesion promotion and wet strength improvement of the metal-polymer adhesive joints, the reliability and durability of composite material bonds may be optimized.

The chemical interaction of various thicknesses of two silane coupling agents on the surface of single crystals of aluminum oxide (sapphire) will be studied using FTIR transmission spectroscopy, internal reflectance spectroscopy, and ESCA. Clarification of the coupling agent-adhesive polymer interaction will be determined by internal reflectance spectroscopy. Correlation of the silane film structure with adhesive joint strength will be determined by peel and sheer lap tests. Durability of joints in wet environments will be related to possible structural changes in the silane films with aging.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0015, BERLINITE CRYSTAL GROWTH

R.F. Belt, Litton Systems Inc., *200 E. Hanover Ave., Morris Plains, New Jersey* 07950 (DF903140; F19628-77-C-0213)

Air Force function - navigation, communication, surveillance. Deficiency - presently available resonator materials cause long term frequency drifting. Objective - to develop superior material for both timing and acoustic surface wave devices. How research contributes -development of new, possibly superior material may result in improved timing and acoustic surface wave devices.

The approach will be the study and growth of berlinite (aluminum phosphate) of sufficient size and quality for evaluation as timing and acoustic surface wave material. The hydrothermal crystal growth technique will be used.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

3.0016, THEORETICAL STUDIES OF INELASTIC AND REACTIVE GAS/SOLID-SURFACE PHENOMENA

J.D. Doll, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Chemistry, *Stony Brook, New York* 11790 (CHE77-16070 A01)

Theoretical studies of inelastic and reactive gas/solid-surface processes will be carried out. Motivated by recent experimental results involving vibrationally inhibited heterogeneous condensation, Doll will consider general internal mode effects for polyatomic/surface collisions. These studies, in addition to examining direct vibrational energy transfer, will explore the implications of resonant vibrational-vibrational processes between gas and previously adsorbed species. The experimentally studied system CO (gas) plus O (adsorbed) yields CO2 (gas) will be studied theoretically. This reaction is of particular importance since essentially all aspects of gas/surface events are involved (e.g. inelastic processes, adsorption, diffusion, reaction, and desorption). The theoretical framework for the studies is the recently developed generalized Langevin theory of gas/solid-surface collisions. This method allows the treatment of general classes of gas/surface phenomena (inherently many-particle

processes) with only minor extensions of currently available 'few-particle' dynamical techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0017, FATIGUE CRACK GROWTH UNDER VARIABLE-AMPLITUDE FATIGUE LOADING (JOINT ARMY/AF GRANT TO THE UNIV. OF PISA, ITALY)
A. Salvetti, U.S. Dept. of Defense, Army, Army Materiel Development & Readiness Command, Research & Standardization Group, *Box 65, FPO, New York, New York* 09510 (DF289800)

The primary objective is to develop a reliable procedure for predicting crack growth under variable amplitude loading in built-up structure.

Crack growth prediction methods will be developed and verified by experiments using aluminum stiffened and unstiffened panels. The payoff will be an improved crack growth method for predicting the life of structure typical of aircraft construction. (AFFDL/FBE will plan to provide funding for FY 80-81.)

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

3.0018, SHEAR BANDS IN FORGED PRODUCTS
A.L. Hoffmanner, Battelle Memorial Inst., *505 King Ave., Columbus, Ohio* 43201 (DF054440; AFOSR-79-0048)

AF function - observations of shear bands have been frequent in conventional titanium alloys used for gas turbine engine compressor blades and aircraft structures, and in nickel alloys used for jet engine components. Opportunity - metal-working processes are designed to produce parts to specified shapes with certain microstructures, and to do so without production of defects which may detract from service performance. These defects run the gamut from internal void formation, inhomogeneous phase distribution, and strain localization, to internal and external fracture. Often, process variables such as working speed and lubrication interact with material properties in the generation of these defects. One example of such an interaction may be cited in the occurrence of shear bands (regions of highly localized deformation crossing many grains) in forged products. Objective - this investigation is to document experimentally the occurrence of shear bands in forged products and to validate analytical techniques for their prediction. In addition, the effect of shear bands on subsequent mechanical behavior before and after typical post-forging heat treatments will be established. How work contributes - the results of this program will lead to much needed understanding of effects and control of a common forging defect which is of vital interest to the Air Force.

The research program will be performed over a 3-year period. In the first year, the mechanical properties of the program material will be determined, the applicability of heat transfer and combined heat transfer-deformation models established, and instability criteria evaluated in a simple deformation mode. During the second year, a simple and a more complex forging will be done to establish the validity of the heat transfer-deformation analysis and instability analysis to simulate more general deformation modes and to determine how these analyses should be used to predict process variables which lead to shear band development. Finally, the third year program will consist of mechanical testing to determine the effect of shear bands on in-service properties. In view of the on-going program on the development of a science base for manufacture of a dual property compressor disk of Ti-6Al-2Sn-4Zr-2Mo, this alloy will be utilized. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0019, HALOGENATION REACTIONS OF GROUP IB ATOMS USING MOLECULAR BEAMS AND SPECTROSCOPIC DETECTION
J.M. Parson, Ohio State University, Columbus Campus, School of Mathematics & Physical Sciences, Dept. of Chemistry, *164 W. 17th Ave., Columbus, Ohio* 43210 (CHE76-11641 A02)

Dr. Parson will use a crossed molecular beam to study reactions of IB atoms with halogens and hydrogen halides. The methods of chemiluminescence and laser-induced fluorescence of product molecules will be used for detection. Quantities to be measured are translational energy dependence of cross-sections, internal energy distributions of products, angular distributions of products, and absolute cross-sections. Special features in the experimental approach include using metastable atomic beams, a secondary beam nozzle source, rotation of the laser light path about the collision center, background light correction by beam modulation, and high-repetition-rate laser pulses for enhanced signal. Emphasis will be on A plus BC reaction types where there are good opportunities for comparison of experimental results with theoretical predictions from potential energy surfaces. Other more immediate objectives involve identification of types of reactants which lead to inverted populations in vibrational or electronic degrees of freedom.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

3.0020, STATISTICAL ANALYSIS OF SOLID PROPELLANT COMBUSTION
R.L. Glick, University of Dayton, Graduate School, *300 College Park Ave., Dayton, Ohio* 45469 (DF054120; AFOSR-79-0022)

AF function - nearly all future Air Force rocket propulsion systems will use solid propellants. Deficiency - current analytical and experimental techniques are inadequate for accurate prediction and assessment of steady and nonsteady combustion characteristics of these propellants. Objective - the purpose of this research is to further develop statistical methods for modeling propellant burning and develop new techniques for analysis of experimental data. How work contributes -when successful, this work will provide a low cost means of accurately selecting propellant formulations that meet mission requirements.

A statistical model has previously been developed for treating the steady state combustion of polydisperse heterogeneous propellants based on the assumption that the macroscopic flame structure of a fuel plain, dotted with concave and/or convex oxidizer surfaces, is an ensemble of non-interacting one-dimensional flames. In the present work, this model will be improved to account for flame interactions by including a binder in the process employed to compute mean rate. The model will also be extended to treat nonsteady combustion as a time-mean phenomenon rather than as the instantaneous response of a real-mean phenomenon. Methods will be developed and coded to extract both multifrequency response function data and statistical parameters defining data quality and reproducibility from pressure-coupled rotating valve burners.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0021, ELEVATED TEMPERATURE BEHAVIOR OF METAL-MATRIX COMPOSITES
B.W. Rosen, Material Sciences Corp., *Blue Bell, Pennsylvania* 19422 (DF054790; F49620-79-C-0059)

AF function - aerospaceframe, spaceframe and engine structure. Deficiency/opportunity - aerospaceframe performance and durability, spaceframe performance and thermal load stability, engine weight, cost and durability all require improvement. Metal matrix composites, with their potential for high temperature stiffness, strength, durability, low weight and low thermal expansion, promise to meet this need. Objective - to develop sufficient understanding of metal matrix composites to be able to use them routinely in Air Force weapons system applications. How work contributes - by increasing understanding of the response of metal matrix composite materials to loads and temperature changes, and by developing models for this behavior which can be incorporated into engineering analysis/design procedures.

Evolutionary, founded on experimentally significant behavior. The material is complex, as is its behavior. Present knowledge of such systems indicates that neither classical analysis nor pure experiment can adequately and frugally characterize their behavior. This work will initially investigate those deformation modes of a unidirectional fiber lamina for which the matrix con-

stitutive nonlinearity and fiber anisotropy is significant, develop one-dimensional lamina constitutive relations which appropriately incorporate load temperature interaction effects, and explore approaches to modeling the three-dimensional behavior of a lamina using the developed 1-D laws.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0022, SUPERSATURATED ALUMINIUM ALLOY POWDERS

D. Schechtman, Technion, *Haifa, Israel* (DF289740; AFOSR-78-3696)

AF function - research and development in structural metals for airframe application. Deficiency - present alloy theory is insufficient to develop new aluminum alloys of higher modulus and higher operating temperature. Contribution - improved alloy theory will allow further development and utilization of aluminum alloys.

The work involves a development and study of supersaturated aluminum alloys based on relatively high content of iron (Fe) and chromium (Cr). Two strengthening mechanisms will be employed; namely, solid solution strengthening and precipitates which are stable at relatively high temperatures. It has been demonstrated in the past that aluminum alloys, fast frozen from the melt, are capable of retaining high concentrations of alloying elements, and form a high density of stable precipitates if given adequate heat treatment. Alloys thus prepared show improvements in mechanical properties at various temperatures both under monotonic and cyclic loading. It is believed that other properties, such as specific modulus elasticity and specific strength at high temperature, can be improved. The aim of this study is to systematically investigate the microstructures and the nature of the precipitates, following various heat treatments, and some mechanical properties obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, CONTRIBUTIVE RESEARCH/RESIDENT SCIENTIST PROGRAM

C. Carroll, Auburn University, School of Engineering, Dept. of Electrical Engineering, *Auburn, Alabama* 36830 (DF684190; F33615-77-C-5003)

Research and development. Research - basic research in the physical and engineering sciences. How research contributes - utilizes unique AFWAL equipment for thorough investigations and knowledgeable evaluations. Offers the opportunity for basic research in the areas of chemistry, solid-state physics, plasma physics, applied mathematics, metallurgy and ceramics, hypersonics, energetics and fluid dynamics within the directed AFWAL approved mission projects.

The broad scope of the AFWAL program and the number of disciplines involved frequently make it desirable to obtain independent studies in specific subjects to extend or amplify various aspects of the program within these laboratories. As specific objectives within each of the laboratories are established, a series of technical goals are devised which lead to the attainment of various AFWAL objectives. These goals are further defined in terms of scientific studies, some of which will be carried out and directed by the AFWAL staff while others will be more effectively performed by contractors with highly specialized skills.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Materials Lab.

4.0002, OPTIMIZATION OF AN INTERACTIVE DISTRIBUTIVE COMPUTER NETWORK FOR PLANETARY AND INFRARED SCIENTIFIC RESEARCH APPLICATIONS

V. Frederick, Foothill De Anza Community College District, De Anza College, Undergraduate School, Dept. of Data Processing, *21250 Stevens Creek Blvd., Cupertino, California* 95014 (NCC 2-31)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0003, ADVANCED TREND ANALYSIS PROCEDURES

Unknown, Systems Control Inc., *260 Sheridan Ave., Palo Alto, California* 94306 (DF462930; F33615-78-C-2062)

To develop advanced engine deterioration trend analysis procedures for improved aircraft engine condition monitoring.

To apply advanced mathematical techniques such as system identification theory in the development of fault isolation and detection software for improved modeling, estimation, and prediction.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0004, NON-RADIATIVE RECOMBINATION IN GALLIUM ARSENIDE PHOSPHIDE

L. Forbes, University of California, Davis Campus, School of Engineering, Dept. of Electrical Engineering, *Davis, California* 95616 (ENG76-80128)

This program will continue an investigation of the effects of copper, iron, and other acceptor impurities on non-radiative recombination in gallium-arsenide-phosphide light emitting diodes. The importance of lattice relaxation and multiple phonon emission at impurity centers will be examined. This work will be compared with previous studies of impurity effects in gallium-phosphide diodes to ascertain if similar mechanisms are responsible for the behavior of the two materials. Energy levels, thermal emission rates, and ionization and capture cross-sections will also be determined for oxygen impurities in GaAsP.

This is a continuation of research previously supported under NSF grant ENG-7419430.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0005, PROPOSED UNIVERSITIES REGIONAL APPLICATIONS PROGRAM WORK PLAN - FY 1980

J.E. Estes, University of California, Santa Barbara Campus, School of Letters & Science, Dept. of Geography, *Santa Barbara, California* 93106 (NCC 2-43)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

4.0006, HIGH SPEED CYLINDRICAL ROLLER BEARING DEVELOPMENT

L. Dobek, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF461730; F33615-77-C-3114)

Extend the state-of-the-art of turbine engine cylindrical roller bearing technology to 3 million DN capability.

Roller bearings will be designed using bearing parameters that have been identified as most important in an existing Navy/Air Force cooperative program with United Technologies, Pratt-Whitney Aircraft Div. Bearings will be fabricated and tested up to 3 million DN. Parameters will be modified and analytical programs will be changed as required to assure a 3 million DN design capability for turbine engine mainshaft roller bearings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0007, DIGITAL ELECTRONIC CONTROL SYSTEM RELIABILITY (FULL AUTHORITY, FAULT-TOLERANT EEC)

M. McGlone, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF464440; F33615-79-C-2082)

This is a dual award contract to evolve design guidance with respect to one facet of the reliability/availability/integrity issue associated with the future development of digital electronic engine control systems - that of providing for very high reliability through the use of redundancy/fault-tolerance, tailored to the needs of variable cycle engine control and optimized with respect to the reliability of the system (and of its components) and to cost of ownership.

Employ the services of two contractors - one skilled in the synthesis of very high reliability, fault-tolerant digital computer systems, and the other skilled in the synthesis of control systems for the engines of high-performance military combat aircraft. Require that they work together closely in a program of study and analysis to produce design guidance needed for the future development of full authority, fault-tolerant (digital) electronic engine control systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0008, A PROGRAM LEADING TO SPECIFICATIONS FOR AVIATION TURBINE FUEL PRODUCED FROM WHOLE CRUDE SHALE OIL

A.O. Braun, Signal Co. Inc., UOP Incorporated, *10 U O P Plaza, Des Plaines, Illinois* 60016 (DF463880; F33615-78-C-2079)

The objectives of this program are to optimize new procedures for the efficient and economic processing of whole crude shale oil into high yields of military fuels while maximizing the yield of aviation turbine fuel and to determine the trade-offs between jet fuel yield, jet fuel properties, and processing costs.

The proposed program will be a 28-month effort incorporating all of the following aspects: (1) process variable analysis, (2) analysis of laboratory samples, (3) production of component test samples, and (4) overall economic optimization by computer model.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0009, NEW TECHNIQUES IN DIGITAL SIGNAL PROCESSING FOR SYNTHETIC APERTURE RADAR

W.K. Jenkins, University of Illinois, Urbana Champaign Campus, School of Engineering, Dept. of Electrical Engineering, *207 Engineering Hall, Urbana, Illinois* 61801 (DF054230; AFOSR-79-0029)

AF function - to advance the technology of radar digital signal processing. Deficiency - in synthetic aperture radar (SAR), in which the data from a side-looking radar on an aircraft is processed by digital techniques, resolution errors for certain target regions are unacceptably high. Objective - to investigate and develop improved processing algorithms to achieve better imagery. How work contributes -success in this research would result in significant radar performance enhancement.

The research will be divided into three parts - 1) digital processing algorithms, 2) architectures for SAR digital processors, and 3) investigations of new techniques for post-processing.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0010, ENERGY CONVERSION - STAGNATION REGION GAS FILM COOLING FOR TURBINE COOLING APPLICATIONS

B.A. Reese, Purdue University, School of Aeronautics & Astronautics, *Life Sciences Bldg., West Lafayette, Indiana* 47907 (DN475466; N00014-75-C-0873)

The objective is to obtain accurate data on the local rate of convective heat transfer to a highly cooled surface exposed to an accelerated, highly turbulent hot gas flow, with particular emphasis on the influence of turbulence scale and intensity and unsteady effects on stagnation region film cooling. The effort is primarily experimental, with analytical modeling backup, and is aimed at optimizing engine performance while utilizing higher turbine inlet temperatures with necessary cooling schemes. The research contributes to increasing the performance of aircraft and marine gas turbine engines.

A two-dimensional rectangular flow channel, with heated air from a gas turbine combustor supplied to a cylindrical film cooled test surface is used to model the turbine vane leading edge. Test equipment has ben modified to permit study of stagnation region film cooling using multiple rows of coolant holes. The cylindrical test surface has been scaled up, with a larger heat transfer surface to permit heat flux gauge installation between holes and rows of holes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0011, DETECTION AND ESTIMATION OF SINGLE EVENT-RELATED POTENTIALS

C.D. McGillem, Purdue University, School of Electrical Engineering, *Executive Bldg., West Lafayette, Indiana* 47907 (DF055280; F49620-79-C-0084)

AF function - workload measures which incorporate reliable/valid electrophysiological techniques will be extremely useful for assessing and predicting human operator performance and requirements in the design and operation of advanced and more complex Air Force systems. Deficiency - little research has been reported that relates directly to the characterization of the transient waveform associated with a single event-related potential. Objective - the proposed research will develop and apply techniques for investigating the characteristics of the single event-related potential. How research contributes - techniques aimed directly at the single evoked brain potential have only recently advanced and require further development and specific characterization in Air Force mission-related contexts for consideration as part of an on-line workload measurement technology which incorporates the best available measures of physiological and neuropsychological processes.

The research will be accomplished through the techniques capable of providing quantitative estimates of parameters associated with individual responses and components of individual response as opposed to the averaging techniques widely employed at the present time.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0012, METAL-OXIDE-SEMICONDUCTOR SOLAR CELL

H.C. Lin, University of Maryland, College Park Campus, School of Engineering, Dept. of Electrical Engineering, *College Park, Maryland* 20742 (ENG76-09933)

An investigation will continue into the use of metal-insulator-semiconductor structures in the fabrication of solar cells. The effort will be directed towards demonstrating experimentally that the performance of such structures can approach that of conventional P-N junction-type cells. One area to be emphasized in the study is the use of transparent conductive electrodes to reduce optical reflection and surface-resistive losses. Also to be investigated is the effect on cell performance of increasing surface state densities and varying processing procedures for insulator growth.

This is a continuation of research previously supported under NSF grant ENG-7419310.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science

4.0013, RESEARCH ON THE DALTON-SILKOLENE PROCESS FOR RECLAIMING SYNTHETIC TURBINE ENGINE LUBRICANTS

A.T. Squires, Dalto Electronics Corp., *Norwood, New Jersey* 07648 (DF463540)

Establish the feasibility of developing the dalton-silkolene refining process for reclaiming mixtures of used Air Force synthetic turbine engine lubricants.

(1) Analysis of used lubricants, (2) identification of contaminants, (3) research on contaminant removal, (4) demonstration of processing techniques on USAF turbine engine lubricants.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0014, MULTIFREQUENCY RADAR CROSS-SECTION MEASUREMENTS

R.B. Mack, Syracuse University, Graduate School, *Steele Hall, Syracuse, New York* 13210 (DF905610; F30602-78-C-0083)

AF function - all weather detection and identification. Deficiency - effective techniques for detection and identification require information on scattering properties of targets. Objective - this program will provide a newly designed facility for multifrequency scattering measurements of radar cross-sections. The installation is to be a part of the new facilities at the IPSWICH, MA field site planned for completion by the end of fiscal year 1979. How research contributes - the range will provide a modern, versatile facility for conducting radar experiments at l to X-band frequencies.

Task description - the task is to design a facility to serve as a multifrequency radar scattering measurement range. The range includes an anechoic room and will be used for both scattering and reflection measurements. The frequency range to be covered is l to X-band. As well as the design of the range, a list of desired auxiliary equipment is to be specified. Dr. Mack's experience in the field of radar scattering measurements - he is presently teaching a course on the subject - will assure a modern, versatile range representative of the most modern technology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0015, CRACK GROWTH INITIATION AND PROPAGATION UNDER DYNAMIC LOADING

M.F. Kanninen, Battelle Memorial Inst., Columbus Laboratories, *505 King Ave., Columbus, Ohio* 43201 (DN775733; N00014-77-C-0576)

Naval structures such as aircraft, missiles, submarines, and surface ships are exposed under service conditions to various forms of dynamic loading which can cause fracture and failure of key portions of these systems. Under this task improvements should be effected in dynamic fracture analysis and experimental techniques which should eventually impact on improved design approaches.

Existing dynamic and elastic plastic analysis procedures will be combined for application to the dynamic tear test specimen. Calculations will be compared with instrumented dynamic tear tests that measure time variations of applied loads, certain displacements, and crack life. Initial studies will be confined to relatively low toughness values and specimens that approximate linear elastic behavior. Work will then proceed to tough materials in elastic plastic behavior. Fracture resistance values will be extracted first from instantaneous loads and crack length measurements. Ways will then be sought to evaluate the resistance from the dynamic tear energy which is simpler to measure.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0016, ADVANCED DIAGNOSTIC ENGINE MONITORING SYSTEM APPLICATION ASSESSMENT - ADEMS II

W.R. Peters, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF455480; F33615-76-C-2025)

The objectives of this program are to design, develop, and evaluate advanced state-of-the-art in-flight computative and sensing techniques incorporated in an advanced diagnostic engine monitoring system (ADEMS II). This system is specifically designed and developed for istallation in selected operational C-5A aircraft for the flight evaluation of capabilities to monitor the condition of one of the TF39-GE-1A engines. This program will provide valuable information on the operational effectiveness of the system incorporated techniques for reducing field maintenance work through correct and timely maintenance actions based upon improved fault isolation and trending capabilities, provide data for effecting cost saving logistic management improvements, and establish engineering guidelines for diagnostic engine monitoring applications for future military aircraft.

The airborne system shall incorporate on-board fault detection pre-and post-failure event recording, selected airborne limit exceedance displays, self-check capability, and provide data for ground processing to develop and define the methodology for in-depth fault isolation, trending for the prediction of maintenance requirements, and history/statistical data for tracking life limited parts for logistic management purposes. Limited engine modifications for the installation of IR pyrometer, internal vibration (externally removable), oil system monitoring and other advanced sensors are required. This work is to be accomplished in six phases: design and definition of ADEMS system and hardware, procurement fabrication and assembly, total system and engine assurance testing, installation and flight evaluation, technical reporting, and low cycle fatigue damage analysis.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0017, DYNAMIC BEHAVIOR OF SPLITTERS AND DUCTS

W. Steenken, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF459120; F33615-77-C-2081)

To define the dynamic interactions which occur at interfaces between engine ducts and other engine components. The effect of these dynamic interactions on engine stability will also be defined.

The program will combine test effort and analytical effort. The test effort will provide dynamic data at the interface to compare with dynamic simulations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0018, SM CO GENERATOR/ENGINE INTEGRATION STUDIES

D.E. Uehling, General Electric Co., *1 Jimson Rd., Cincinnati, Ohio* 45215 (DF460900; F33615-77-C-2018)

To establish and demonstrate the feasibility of integrating a Sm Co starter generator into an aircraft jet engine.

The generator/engine interface will be defined based upon a specific application, the design and performance requirements will be established and a model device fabricated to demonstrate performance.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0019, POTENTIAL-COMPLEX LAMELLAR DECOMPOSITION OF FLUID FLOWS

R.L. Panton, University of Texas, Austin Campus, School of Engineering, Dept. of Mechanical Engineering, *200 W. 21st, Austin, Texas* 78712 (DF054700; AFOSR-79-0081)

AF function - aerospace vehicle design. Deficiency - modeling of turbulent flow is almost entirely empirical. Objective - application of a reformulation of the fluid flow equations in a form more natural to the study of vorticity. How work contributes - better turbulence modeling should lead to better aircraft design.

The classical mathematical decomposition of the velocity field in turbulent flow due to CLEBSCH or MONGE separate out that part of the velocity field that is non-zero only in the vorticity-containing regions of the flow. The research will attempt to pick a unique transformation and apply the decomposition to selected problems where there is a strong interaction between potential and viscous flow components. Possible problem areas include three-dimensional boundary layers, wall turbulence, aerodynamic generation of sound and flows with strong interactions. A primary goal is to explore the general characteristics of the decomposition whose literature is both sparse and sketchy in an attempt to understand aspects such as the various restrictions employed to make the decomposition unique, the differing physical interpretations, (should vortex lines be fixed in the fluid, or in steady flow, fixed in space?) and the selection of coordinate surfaces.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0020, POWER SYSTEM CONTROL STUDY
J. Perkins, Vought Corp., *P.O. Box 5907, Dallas, Texas* 75222 (DF462270; F33615-78-C-2018)

The purpose of this program is to define, design, and analyze an advanced, integrated aircraft electrical generation and control system which will provide the high quality, reliable, no gap power required by next generation Air Force weapon systems. A primary objective of the system design and study, therefore, encompasses the development and application of state-of-the-art technology for yielding a cost-effective electrical generation-control system which will not sustain first or second order faults or failures that result in complete loss of power.

In this study advanced system concepts will be examined. Such concepts include use of (1) solid-state switching in areas of power generation and control, bus and load switching and signal sensing, (2) samarium cobalt permanent magnet VSCF generator/starter implementation, (3) smart terminal (microprocessor controllers) applications in areas of the generator control unit, universal multiplex terminal, and integrated load management center designs, (4) dynamic load management and generator control via the EMUX sensory and data processing capabilities, (5) distributed load management, (6) automated and continuous built-in test and MIL-STD-1553 compatible multiplexing using TSPC (twisted shielded pair) and F/O (fiber optic) data busing techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

4.0021, RADIATION PRODUCTION BY CHARGED PARTICLE BEAMS EJECTED FROM A PLASMA FOCUS
G.M. Molen, Old Dominion University, School of Engineering, Dept. of Electrical Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (DF055950; F49620-79-C-0151)

AF function - the AF must be able to assure that its systems are hardened to withstand certain radiation levels from nuclear weapons. Deficiency - no laboratory radiation source can produce high enough intensities to simulate nuclear weapons effects over system size volumes. Objective - this research program is aimed at understanding a new X-ray source which the PI has developed. This new X-ray source is based upon a focused electron beam produced by a plasma focus device. Dr. Molen intends to measure the characteristics of both the electron beam and the X-rays it produces. Contribution - this research program will contribute to the development of laboratory radiation sources to simulate nuclear weapons effects.

The Mark IV plasma focus system will be transferred from the Aerospace Corporation to the Electrical Engineering Department at Old Dominion University and will be assembled and made operational. The system will be configured so as to produce a focused electron beam directed into the anode. Extensive diagnostics will be made on the ejected electron beam current that is transported through the drift tube. A high frequency Faraday cup will be modified to measure contributions to the electron current from lower energy electrons. Qualitative estimates of the electron energy of the beam will be made by the use of various thicknesses of dielectric films for which the forward electron range is known. The temporal current profile measured with the Faraday cup will be compared with X-ray emission from the converter region as well as the softer bremsstrahlung radiation produced at the plasma pinch.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, GLOBAL ATMOSPHERIC ENERGY INPUT DUE TO ELECTRONS PRECIPITATED BY MAN-MADE VLF EMISSIONS
A.L. Vampola, Aerospace Corp., Space Sciences Laboratory, *P.O. Box 92957, Los Angeles, California* 90009 (ATM77-28187)

This grant provides partial support for data processing and analysis for a study of energy input into the upper atmosphere due to electrons precipitated by interaction with man-made electromagnetic waves. The study covers a new area of investigation: the modification of the magnetospheric energetic electron population by very low frequency (VLF) waves from ground-based transmitters and power-line harmonics. The data involved were obtained by a magnetic electron spectrometer on the S3-2 satellite during the period December 1975 to present. As part of the tasks, the data will be reduced, processed to provide ephemeris and magnetic aspect, and furnished to the National Space Science Data Center for use by other investigators.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0002, EVOLUTION OF THE ATMOSPHERE OF VENUS
Y.L. Yung, California Inst. of Technology, Graduate School, Dept. of Geological & Planetary Sciences, *1201 E. California Blvd., Pasadena, California* 91109 (NCC 2-61)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0003, SEASAT PROGRAM - EVALUATION OF OPEN OCEAN MEASUREMENTS BY THE SEASAT-A SYNTHETIC APERTURE RADAR DURING THE 1978 JOINT AIR-SEA INTERACTION
A.M. Peterson, Stanford University, Center for Radar Astronomy, *Stanford, California* 94305 (7-922; MO-AO1-78-00-4318)

OBJECTIVE: The extensive wind and wave measurement to be made during the Joint Air-Sea Interaction (JASIN) experiment will be utilized to evaluate the measurement of ocean wave directional spectra by the SEASAT-A SAR. Information will be obtained concerning the range of ocean wavelengths and observational parameters over which reliable measurements of directional spectra can be made using SAR images, the dominant radar wave/ocean wave interaction mechanism(s) which allow SAR to image long wavelength ocean waves and then effects of local winds on SAR images.

APPROACH: The SEASAT-A/JASIN collaborative research effort will include SAR data collection for the JASIN area; SAR images formation, including geometric and focussing corrections; SAR image processing; comparison of SAR and surface measurements sigma (k, Omega); and evaluation of SEASAT-SAR measurements of sigma. The principal conclusion to be drawn from the data comparison is over what range of observational parameters, and wind and wave conditions, can SEASAT SAR images be used to provide meaningful estimates of the ocean wave directional spectrum.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0004, IRRIGATED LANDS ASSESSMENTS FOR WATER MANAGEMENT
R.N. Colwell, University of California, Berkeley Campus, School of Natural Resources, Dept. of Forestry & Resource Management, *Berkeley, California* 94720 (NCC 2-54)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

5.0005, RE-FORMAT AND DOCUMENTATION OF A SURVEY PLANNING MODEL
I.C. Wensel, University of California, Berkeley Campus, School of Natural Resources, Dept. of Forestry & Resource Management, *Berkeley, California* 94720 (NAS 9-15987)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0006, DEVELOPMENT OF A PLAN FOR FUNDAMENTAL RESEARCH IN ELECTROMAGNETIC RADIATION CHARACTERISTICS FOR RENEWABLE RESOURCES AND FEATURES
J.A. Smith, Colorado State University, School of Natural Sciences, Dept. of Earth Resources, *Fort Collins, Colorado* 80523 (NAS 9-16016)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0007, DOMESTIC HOT WATER SYSTEM TEST SUPPORT
Unknown, State University System of Florida, University of Florida, Graduate School, *Gainesville, Florida* 32601 (NAS 8-33761)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

5.0008, COMPREHENSIVE STUDY OF POSSIBLE SOLAR ACTIVITY INFLUENCES ON THE UPPER STRATOSPHERE AND MESOSPHERE
C.G. Justus, Georgia Inst. of Technology, School of Engineering, Dept. of Aerospace Engineering, *225 North Ave. N.W., Atlanta, Georgia* 30332 (ATM77-05967)

This grant funds a study of possible influences of solar activity on the upper stratosphere and mesosphere (25-90 km). The indices of solar activity whose possible influences will be studied are: 1) the AE index, a measure of global electrojet activity, 2) the magnetic storm index Dst, 3) the solar radio noise flux at 10.7 cm wavelength F 10.7, 4) the 1000 A to 3500 A UV flux as measured by satellite, 5) the 1 A to 20 A X-ray flux as measured by satellite, 6) solar proton flux as measured by satellite, 7) solar magnetic sector boundary crossings, 8) solar magnetic sector intensities, 9) the Zurich sunspot number, and 10) and the satellite measured near-earth cosmic-ray flux (to investigate potential effects of solar magnetic field modulations on cosmic-ray flux and resultant influence on ionization). The meteorological parameters of the 25-90 km altitude region whose possible influence by solar activity is to be studied are: 1) departures of measured temperature, density, pressure, zonal wind, and meridional wind from 'climatological' monthly means, 2) the magnitude of gravity waves and planetary waves, as deduced by the daily difference analysis method, 3) weekly stratospheric circulation index and thickness values for the 30 degrees to 70 degrees latitude area between pressure heights to 5 mb and 0.4 mb.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0009, FIELD-ALIGNED CURRENTS IN THE POLAR REGIONS
T.A. Potemra, Johns Hopkins University, Applied Physics Lab., *Johns Hopkins Rd., Laurel, Maryland* 20810 (ATM76-81211 A01)

This grant will support a program of acquisition, analysis and interpretation of the data obtained from the Navy/Applied Physics Laboratory satellite TRIAD. The TRIAD magnetometer experiment remains the only means of studying field-aligned currents at relatively low satellite altitudes on a continuous basis. The program would establish an automatic data acquisition ground station at Resolute, Canada, and continue the operation of the station at McMurdo, Antarctica. Selected passes of TRIAD magnetometer data from College, Alaska, will be collected for correlation with the radars located at Chatanika and Homer, Alaska, and from Fort Churchill, Canada, and Prince Albert, Canada, for correlation with various ground-based magnetometer chains and radar observations scheduled for the IMS (International Magnetospheric Study). The primary objectives of this study are: (1) To determine the distributions and characteristics of magnetic disturbances (and the related field-aligned currents) in the polar cap and cusp region. (2) To correlate the characteristic field-aligned currents in the polar cap, cusp and auroral region with ionospheric current systems determined from the extensive ground-based observations scheduled for the IMS. (3) To determine the relationship of field-aligned currents with ionospheric scintillations observed to the VHF transmissions from TRIAD. (4) To continue the correlation of the TRIAD magnetometer data with measurements of low-energy electron fluxes from the Atmosphere Explorer C and D satellites.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0010, SYNOPTIC ANALYSIS
Unknown, Systems & Applied Sciences Corp., *6811 Kenilworth Ave., Riverdale, Maryland* 20840 (DF581710; F19628-78-C-0138)

AF function - strategic offense and defense. Deficiency - lack of quantitative data to define atmospheric hydrometeor distributions associated with synoptic scale meteorological patterns.

Perform analyses of synoptic meteorological patterns associated with flight track of specially instrumented cloud physics research aircraft. How development contributes - analyses developed permit climatological correlation of synoptic scale meteorological patterns with particle distributions, liquid water content, and other pertinent cloud physics parameters for quantitative assessment of environmental effect on aerospace operations.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0011, VIBRATIONAL NITRIC OXIDE ION STUDY
M. Camac, Aerodyne Research Inc., *Bedford Research Pk., Bedford, Massachusetts* 01730 (DF243580; F19628-76-C-0178)

AF function - detection and surveillance. Deficiency - inadequate knowledge of the upper atmosphere during disturbed conditions, e.g., nuclear explosions and auroras. Research - the vibrational transfer rate to molecular nitrogen and molecular oxygen are measured for nitric oxide ions. How research contributes - nitric oxide ions are important SWIR emitters in the disturbed ionosphere. The proposed measurements will lead to improved ability to predict the expected SWIR emission intensities.

Laboratory measurements of vibrationally excited nitric oxide ions are undertaken in order to determine the rate of transfer of vibrational energy to molecular nitrogen and molecular oxygen. Relative photoionization cross-sections will also be measured for the 0 through 4 vibrational level of the ion. If possible, the relative recombination coefficient will be measured for ions in levels 1 through 4. Two new items are being added to the approach. First, F-numbers for nitric oxide ions as measured on subject contract will be used to reanalyze previous U.S. nuclear test data in the IR. Secondly, IR absorption data concerning UO and its ion will be measured with the use of a commercially available infrared tunable diode laser whose output is passed through a white cell integrated with the flow reactor.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0012, DEVELOP STRATOSPHERIC COMPOSITION IDENTIFICATION INSTRUMENT
H.A. Miranda, Epsilon Lab. Inc., *Bedford, Massachusetts* 01730 (DF582070; F19628-78-C-0168)

AF function - environmental impact of stratospheric aircraft and missile operations. Deficiency - inadequate understanding of the role of aerosol particles in the removal of pollutants deposited in the stratosphere. Objective - develop an instrument to make in-situ measurements of aerosol particle number density and particle composition. How research contributes - completion of effort will provide an instrument design which can be fabricated and used to measure aerosol particles in the stratosphere, thus providing better inputs on the role of aerosols in stratospheric processes and allow more accurate impact statements.

Develop an instrument design for in-situ measurement of stratospheric aerosols. The instrument would be designed for balloon flight at various stratospheric altitudes. The instrument

is envisioned to measure particle composition by vaporizing the particle with a laser beam and measuring the vaporized material with spectral techniques. This work effort is devoted to a theoretical and laboratory study to determine the feasibility of the concept and to demonstrate that feasibility through the use of a breadboard hardware model. The results will be a set of design specifications from which a flight instrument could be fabricated.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0013, GEOPHYSICAL STUDY OF THE STRUCTURES AND PROCESSES OF THE CONTINENTAL CONVERGENCE ZONES
P. Molnar, Massachusetts Inst. of Technology, School of Science, Dept. of Earth & Planetary Sciences, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NCC 5-8)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0014, WIND AND TURBULENCE MEASUREMENTS AND THEORETICAL APPLICATION
I.I. Kofsky, Photometrics Inc., *Lexington, Massachusetts* 02173 (DF580500; F19628-78-C-0171)

AF function - low altitude operational satellites and ballistic nuclear weapon delivery. Deficiency - trajectory of missiles and satellites cannot be precisely calculated. Research - utilization of measured turbulent transport parameters in model atmospheres. How research contributes - permits more accurate calculations of dynamic model atmospheres. The results can be used to predict missile reentry and satellite orbit calculations.

The upper atmospheric turbulent motions will be determined from the fine detailed wind measurements (with a discrimination length of approximately 50 m) by the use of a Richardson number filter. These determined values of turbulent kinetic energy will then allow us to accurately estimate the rate of turbulent dissipation in the chemical release trail. Spectral analysis permits us to determine directly the turbulent rate of dissipation, from which the turbulent diffusion coefficients may be determined.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0015, R AND D OF MATH AND PHYSICS MODELS
J. McCann, R D P Inc., *Waltham, Massachusetts* 02154 (DF249940; F19628-76-C-0212)

Research - infrared radiation pattern studies. How research contributes - performance of mathematical and statistical analysis of infrared background data obtained from rocket probes will improve means of detection.

Using mathematical and statistical techniques, models will be developed for the determination of multi-channel cross-talk matrices. Methods of numerical analysis, Fourier and optimization techniques will be applied for the (1) calibration of sensor and payload instrumentation, (2) processing of two-dimensional IR imagery data, and (3) infrared probe data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0016, AEROSPACE PAYLOAD R AND D
J.M. Otis, Wentworth Inst. of Technology, Undergraduate School, *550 Huntington Ave., Boston, Massachusetts* 02115 (DF247640; F19628-76-C-0211)

AF function - reconnaissance, surveillance, communication and advanced weapon systems. Deficiency or opportunity - inability to forecast atmospheric interactions affecting the design and operation of military systems such as re-entry vehicles, over-the-horizon radar and satellite operations. Objectives - (a) to perform research and engineering as required in the design, fabrication and test of aerospace payloads and G S E sensors; (b) to redesign, fabricate, test and evaluate component assemblies of existing aerospace vehicles for the purpose of improving reliability and/or cost-effectiveness. How research contributes - the complexities of upper atmosphere and near-space in situ measurements demand state-of-the-art expertise if meaningful data are to be retrieved. Improved construction techniques and designs can only enhance reliability of experiments directly related to AFGL projects 2310, 6688, 6690, 7659, 7661, 7670, 8658 and SAMSO program 2127.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0017, MEASUREMENTS OF ATMOSPHERIC CHLOROFLUOROCARBONS AND NITROUS OXIDE AND INTERPRETIVE AND THEORETICAL STUDIES IN ATMOSPHERIC CHEMISTRY
R.J. Cicerone, University of Michigan, Ann Arbor Campus, School of Engineering, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM78-26728)

This research involves both theoretical and experimental studies of atmospheric chemistry. Numerical modeling investigations of the chemistry and physics of the stratospheric ozone layer and of the non-urban troposphere will be conducted.

Measurements of tropospheric chlorocarbons, chlorofluorocarbons and of nitrous oxide by electron-capture gas chromatography will also be performed. In general, the compounds to be measured are gases that are capable of influencing stratospheric photochemistry and/or the outgoing planetary infrared radiation and they are partly or mostly anthropogenic. To assure proper identificaiion of certain species and to detect several others, a limited amount of cryogenic pre-enrichment mass spectrometric work will be undertaken.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0018, EFFECT OF BEAM-PLASMA INTERACTIONS IN HIGH LATITUDE IONOSPHERE
E.G. Fontheim, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM77-24960)

This grant funds studies of precipitating particles and of the causes and effects of plasma turbulence in the high latitude ionosphere. It allows: 1) The analysis of electron precipitation spectra aimed at learning more about their origins as well as about their effects on the background plasma. This study involves extensive use of data from AE-C and D, INJUN5, Hawkeye 1, and the IMP series. 2) Investigation of whether downstreaming energetic protons may transfer their energy to electrons on auroral field lines in regions of plasma turbulence, thereby giving rise to intense inverted-V precipitation. 3) Study of the mechanisms which could give rise to plasma turbulence and anomalous transport effects at lower altitudes (h less than or equal to 500 km) and solution of the coupled set of conservation equations with anomalous transport coefficients. This study involves extensive use of Chatanika Incoherent scatter radar data and satellite data from AE-C and D and S3-3.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0019, EXPERIMENTAL AND THEORETICAL AIRGLOW STUDIES
P.B. Hays, University of Michigan, Ann Arbor Campus, School of Literature Science & the Arts, Dept. of Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48104 (ATM77-26889)

The principal goal of the research to be funded by this grant will be to continue the development of techniques to remotely sense the state of the atmosphere. Emphasis is placed on the use of optical methods involving high resolution spectroscopy to infer the physical condition of the high atmosphere from the shape and position of emission lines in the airglow spectrum. The scope of measurements will be extended to include the stratosphere and mesosphere by using absorption features in the scattered sunlight spectrum. The approach used combines the experimental and theoretical work in the area of atmospheric optical emissions and related physical processes

into a unified endeavor. In addition to this general ongoing program of upper atmospheric research, a notable piece of new equipment is to be designed and constructed. The ability to significantly extend the general usefulness of multiple stacked Fabry-Perots (PEPSIOS) to atmospheric physics is promised by the technological achievement of slaving three Fabry-Perot etalons externally using computer controlled scans of each of the independent etalon systems. We can select any wavelength region without mechanical adjustment of the system. The use of widely separated free spectral ranges in the instrument allows basic wavelength stability high resolution systems using modest lower resolution scanning techniques.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0020, STUDY TO IMPROVE PARAMETERS FOR A WINTER WHEAT MODEL
J.M. Caprio, Montana State University, School of Agriculture, Dept. of Plant & Soil Science, *Bozeman, Montana* 59715 (NAS 9-16007)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

5.0021, A PHYSICAL INVESTIGATION OF AREA OF EFFECT OF CLOUD-SEEDING IN SIERRA NEVADA
J.A. Warburton, University of Nevada, System Office, Desert Research Inst., *Reno, Nevada* 89507 (ATM78-12215)

Increasing precipitation through cloud seeding has been demonstrated for certain orographic cloud systems in the Rocky Mountains. The total area affected by such modification has not been ascertained and represents an important societal as well as scientific issue.

This research seeks to determine whether cloud seeding on the (California) western slopes of the Sierra Nevada affects the cloud systems sufficiently to provide detectable changes in the precipitation falling on the (Nevada) eastern slopes of the Sierra. An advanced aircraft measurement and sampling system is being used to study changes in the physics of the precipitation process. There are three specific elements of the precipitation physics research: (1) To measure the content of the silver iodide and other ice nucleating aerosol tracers in the liquid and ice phases within the cloud systems. (2) To investigate the occurrence and persistence of supercooled liquid water passing over the mountain during various stability conditions. (3) To measure the spatial distribution of ice crystal concentrations and habits in relation to vertical mixing and the distribution of liquid water. New equipment has been constructed and installed in the aircraft for the airborne collection of supercooled liquid water and bulk ice crystals needed for the chemical analysis. The field research is being conducted over and on the downwind slopes of the Sierra Nevada and is closely coordinated with the operations of the Sierra Cooperative Pilot Project.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0022, GAS-SURFACE INTERACTIONS IN CRYOGENIC WHOLE AIR SAMPLING
J.M. Calo, Princeton University, School of Engineering & Applied Sciences, Dept. of Chemical Engineering, *Box 430, Princeton, New Jersey* 08540 (DF248590; F19628-77-C-0071)

AF function - stratospheric trace gas measurements are conducted to establish if Air Force flight operations are altering the composition of the stratosphere in any way which might produce a harmful environmental change. Deficiency or opportunity - there exist physico-chemical problems related to the collection, storage, manipulation, transfer and analysis of these gases by cryogenic techniques. Objective - under the contractual effort, theoretical and laboratory experimental investigations are intended to determine sticking and flaking of the gas species on cryogenic surfaces composed of various materials and to study potential chemical conversions on such surfaces.

A vacuum chamber/gas sampling system employing mass spectrometry for diagnostics will be designed and constructed. Gas samples, chosen for their applicability to stratospheric composition studies, will be introduced to the system and chemical conversions and sticking and flaking on cryogenic surfaces of different materials will be investigated. Also, the effects of sampling rates and modes as well as sample warmup will be studied. NO-to-NO sub-X conversion and determination of sticking coefficients for freons 11 and 12 on cryogenic surfaces will receive special attention.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, DOMESTIC HOT WATER SYSTEM TEST SUPPORT
Unknown, New Mexico State University, Las Cruces Campus, Graduate School, *University Park, Las Cruces, New Mexico* 88003 (NAS 8-33764)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Headquarters

5.0024, APPLICATION OF DIGITAL ANALYSIS OF MULTI-SPECTRAL SCANNER TO AGRO-ENVIRONMENTAL STUDIES
R.A. Lewis, Columbia University, Graduate School, *109 Low Memorial Library, New York, New York* 10027 (NCC 5-20)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

5.0025, WAVES AND WAVE COUPLING IN THE ATMOSPHERE
S.H. Gross, Polytechnic Inst. of New York, Brooklyn Campus, School of Science & Engineering, Dept. of Engineering, *333 Jay St., Brooklyn, New York* 11201 (ATM78-09509)

This grant funds research on the transport of energy and momentum by wave processes in the upper atmosphere and on the source regions for these waves. The data base utilized for this purpose will include data from the Atmospheric Explorer satellite. The effort will accentuate those waves that may originate in auroral regions or in lower layers of the atmosphere, as, for example, the troposphere. The research is concerned with the mechanisms for the propagation of these waves through the layers of the atmosphere and the deposition of their energy and momentum in these regions.

It is planned to select and analyze density data for individual species and the total medium, as well as temperature and species velocity data to seek correlative behavior between species and evidence of their wave amplitude and phase responses. Modeling analysis will enable the determination of important wave parameters from the data and will indicate the direction to the energy source region. Correlative studies with other geophysical data, with meteorological data, with data from incoherent backscatter radar, with Doppler sounder and ionosonde data will also be utilized to infer source locations and characteristics. The deduced wave parameters will enable the determination of momentum and energy transport fluxes as well.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

5.0026, ELASTICITY OF POLYCRYSTAL AND SINGLE CRYSTAL SPECIMENS OF MINERALS SYNTHESIZED AT HIGH PRESSURES
R.C. Liebermann, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Sciences, *Stony Brook, New York* 11790 (EAR76-84066)

No unique interpretation of the seismic velocity and density models of the Earth's mantle in terms of composition and mineralogy is yet possible. Part of this ambiguity is due to an insufficient knowledge and understanding of the variation of elasticity with pressure, temperature, composition and phase. This is a project to address the effects of these variables on the elastic properties of minerals. Specifically, polycrystals (dimensions 1

mm or greater) will be hotpressed and single crystals (dimensions 10 mm or greater) will be grown at pressures up to 60 kilobars in solid-media apparatuses and their elastic properties measured on recovery by ultrasonic and Brillouin scattering techniques. The choice of sample composition will be dictated by the need to exhibit potential mantle crystal structures within the pressure range of synthesis. Such studies should enhance our ability to interpret more exactly the compositional and mineralogical nature of the transition zone of the Earth's mantle as delineated by seismological observations.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Earth Sciences

5.0027, AN INVESTIGATION OF LABORATORY-PRODUCED SOLIDS AND LIQUIDS AS CANDIDATES FOR THE SCATTERING AEROSOLS IN OUTER PLANET ATMOSPHERES

T. Owens, State University of New York, Stony Brook Campus, School of Arts & Sciences, Dept. of Earth & Space Science, *Stony Brook, New York* 11790 (NCA 2-760001)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0028, STUDIES OF ROCKET-BORNE PROBES USED IN MEASUREMENTS OF THE MIDDLE ATMOSPHERE

T.M. York, Pennsylvania State University, University Park Campus, Ionosphere Research Lab., *201 Shields Bldg., University Park, Pennsylvania* 16802 (ATM76-81004 A01)

This grant funds a theoretical and laboratory study of rocket-borne ion mobility probes, to help understand the results obtained by these probes.

The three specific problems that will be addressed are: 1. Theoretical studies of electron collection by blunt probes. A new approximate theory has been developed for continuum collection but further detailed studies are needed to complete the analysis and perform comprehensive evaluation of probe data. 2. Theoretical studies of ion collection by a Gerdien condenser probe with an attached UV lamp. The creation, diffusion, and convection of ions from an axial beam must be studied to determine the details of the particle transport in this mobility spectrometer device. 3. Laboratory experimental studies of scaled probe flows. A new type of facility has been developed for testing scaled probes in laboratory flows. This study will consider collisional flows with blunt probes and the ion collection processes in the Gerdien with UV lamp device.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0029, SCIENCE AND APPLICATION TEAM FOR THE LIGHTNING OBSERVATION FROM SPACE DEVELOPMENT PROGRAM

A.A. Few, Rice University, School of Natural Sciences, Dept. of Space Physics & Astronomy, *6100 Main, Houston, Texas* 77001 (NAS 8-33715)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
George C. Marshall Space Flight Center

5.0030, BASIC RESEARCH PLANNING IN PATTERN RECOGNITION IMAGE PROCESSING

L.F. Guseman, Texas A & M University, College Station Campus, School of Science, Dept. of Mathematics, *College Station, Texas* 77843 (NAS 9-15964)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

5.0031, ALASKAN INCOHERENT SCATTER RADAR INVESTIGATIONS OF THE HIGH-LATITUDE IONOSPHERE

J.R. Doupnik, Utah Higher Education System, Utah State University, Center for Research in Aeronomy, *Main Bldg., Office 104, Logan, Utah* 84321 (ATM78-05747)

This grant funds over a two-year period the continuation of Utah State University's investigations of the high-latitude ionosphere. These investigations are carried out with the Incoherent Scatter Radar Facility operated in Chatanika, Alaska, by the Stanford Research Institute.

The incoherent scatter radar bounces radio signals off the charged particles (electrons and ions) in the ionosphere, a region located from about 80 to 600 kilometers above the earth's surface. From the characteristics of the radio echoes the density and the velocity of the charged particles may be immediately determined. Additional analysis yields information on the temperatures of the particle species, the magnitude and direction of ionospheric electric fields and currents, and the motion of the neutral atmosphere.

These measurements will be used in studies of related phenomena that range from relatively local to interplanetary in size. At the small end of the scale the fields and currents associated with auroras and the production and effects of precipitating energetic particles will be studied. On a larger scale the structure of the high-latitude ionosphere and the role of electric fields in determining that structure will be examined. Finally, the processes by which the solar wind is linked to the earth's magnetic field will be investigated. Each of these investigations is important in itself; each will also contribute significantly to our understanding of the possible mechanisms through which the sun influences our weather and climate.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Atmospheric Sciences

5.0032, COUPLED RADIOACTIVE-CHEMICAL STUDIES OF THE EARTH'S TROPOSPHERE

S.N. Tiwari, Old Dominion University, School of Engineering, Dept. of Engineering, *5201 Hampton Blvd., Norfolk, Virginia* 23508 (NCC 1-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

5.0033, APPLICATION OF ADVANCED LIDAR TECHNIQUES FOR ATMOSPHERIC REMOTE SENSING

E.C. Kindle, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics & Geophysical Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NCC 1-28)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

5.0034, ENVIRONMENTAL EFFECTS ON ADVANCED COMPOSITES

J. Unnam, Virginia Polytechnic Inst. & State University, School of Engineering, Dept. of Metallurgical Engineering, *Blacksburg, Virginia* 24061 (NCC 1-10)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Langley Research Center

5.0035, AN EVALUATION OF ENVIRONMENTAL DATA HANDLING IN GEOGRAPHIC INFORMATION SYSTEMS

J.W. Scott, Western Washington University, School of Arts & Sciences, Dept. of Geography, *516 High St., Bellingham, Washington* 98225 (NCA 2-862001)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

5.0036, THE ARCTIC STRATUS EXPERIMENT
G.F. Herma, University of Wisconsin, Madison Campus, Graduate School, Dept. of Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DPP77-23882)

During the summer of 1979, the radiative properties of summer stratus clouds in the Arctic will be measured using an instrumented aircraft (the NCAR Electra) flying out of Point Barrow, Alaska. These data, along with dynamical and cloud microphysical data collected by other researchers cooperating in this study, will be used to determine the role of summer stratus clouds in the Arctic heat balance.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Polar Programs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, REGULATION OF NUTRIENT AVAILABILITY AND PLANT NUTRIENT UPTAKE IN CONTROLLED ENVIRONMENTS
A.J. Bloom, University of Alaska, Fairbanks Campus, Graduate School, *Fairbanks, Alaska* 99701 (NCA 2-20902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0002, STUDIES IN ORIGIN-OF-LIFE RESEARCH SEARCH FOR EXTRA-TERRESTRIAL INTELLIGENCE
C.L. Seeger, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave., San Francisco, California* 94132 (NCC 2-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0003, EFFECTS OF CENTRIFUGATION ON GONADAL AND ADRENOCORTICAL STEROID IN RATS
R. Kakihana, California State University & Colleges, San Francisco State University, School of Science, Dept. of Biology, *1600 Holloway Ave., San Francisco, California* 94132 (NCC 2-25)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0004, COOPERATIVE RESEARCH ON FLIGHT MANAGEMENT
B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCC 2-34)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0005, SIMULATION TECHNOLOGY - HUMAN PERFORMANCE IN IN-FLIGHT SIMULATION (ABSTRACT)
B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCC 2-35)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0006, HELICOPTER HUMAN FACTORS
B. Clark, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCC 2-37)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0007, A SELF-REPORT METHOD FOR MOTION SICKNESS ASSESSMENT IN THE SQUIRREL MONKEY - ITS USE IN HABITUATION AND SENSORY CONFLICT STUDIES
R. Ginsberg, California State University & Colleges, San Jose State University, School of Social Sciences, Dept. of Psychology, *Washington Sq., San Jose, California* 95192 (NCA 2-675002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0008, PERCEPTUAL PROBLEMS IN AERONAUTICS
K. Karamcheti, Stanford University, School of Engineering, Dept. of Aeronautics & Astronautics, *Stanford, California* 94305 (NCC 2-44)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0009, IMPLANTABLE INSTRUMENTATION FOR STUDIES OF BLOOD FLOW DISTRIBUTION
J.D. Meindl, Stanford University, School of Engineering, Dept. of Electrical Engineering, *Stanford, California* 94305 (NCC 2-38)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0010, CARDIOVASCULAR MAGNETIC MEASUREMENTS
D.C. Harrison, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCC 2-51)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0011, BIOMEDICAL TECHNOLOGY TRANSFER
D.C. Harrison, Stanford University, School of Medicine, Dept. of Medicine, *Stanford, California* 94305 (NCC 2-52)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0012, PRIMITIVE PHOTOBIOLOGICAL MECHANISMS OF SALT TRANSPORT
L. Packer, University of California, Berkeley Campus, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NCA 2-50002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0013, AN ANALYSIS OF ANTICIPATED PSYCHOSOCIAL REQUIREMENTS FOR FUTURE SPACE FLIGHT
A.A. Harrison, University of California, Davis Campus, School of Letters & Science, Dept. of Psychology, *Davis, California* 95616 (NCC 2-48)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0014, CHARACTERIZATION OF ESTEROPEPTIDASES IN RAT TISSUES BY GEL ELECTROPHORESIS
A. Parlow, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NCA 2-390001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0015, STUDIES ON THE LOCALIZATION AND INTERCONNECTIONS OF EMETIC TRIGGER ZONES IN THE CENTRAL NERVOUS SYSTEM
R.L. Snyder, University of California, San Francisco Campus, Graduate School, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665003)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0016, ULTRASTRUCTURAL STUDIES OF IONIC TRANSFER THROUGH BONE CELL SHEETS IN ISOLATED PERFUSION CULTURE
C.D. Arnaud, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665906)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0017, MECHANISMS OF HORMONE-TISSUE INTERACTIONS IN ALTERED GRAVITY STATES
I. Goldfine, University of California, San Francisco Campus, School of Medicine, Dept. of Medicine, *551 Parnassus Ave., San Francisco, California* 94122 (NCA 2-665001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0018, HISTOPATHOLOGICAL CHANGES IN RODENTS CAUSED BY HZE PARTICLE IRRADIATION
E.V. Benton, University of San Francisco, School of Science, Dept. of Physics, *2130 Fulton, San Francisco, California* 94117 (NCC 2-47)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0019, AN ANALYSIS OF ANTICIPATED PSYCHOSOCIAL REQUIREMENTS FOR FUTURE SPACE FLIGHT
F. Rakinz, University of Santa Clara, Graduate School, *Santa Clara, California* 95053 (NCC 2-49)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0020, ENZYME-LINKED IMMUNOSORBENT ASSAY (ELISA) FOR DETECTING UPPER RESPIRATORY TRACT INFECTION
L.D. Caren, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0021, BIOASSAYABLE GROWTH HORMONE - ISOLATION DEVELOPMENT OF A RADIOIMMUNOASSAY AND VALIDATION OF THE ASSAY
T. Fast, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685003)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0022, THE DISTRIBUTION OF OXYGEN SENSITIVITY AMONG BACTERIAL DENITRIFIERS WITH PARTICULAR EMPHASIS ON ITS ECOLOGICAL SIGNIFICANCE
G.A. Tomlinson, University of Santa Clara, School of Science, Dept. of Biology, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685004)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0023, LIFE SCIENCES SHUTTLE INSTRUMENTATION DEVELOPMENT
R.E. Sturm, University of Denver, Graduate School, *2115 S. University Blvd., Denver, Colorado* 80210 (NAS 9-15991)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0024, INVESTIGATION OF THE MECHANICAL PRINCIPLES OF THE BALLISTIC MOTION OF THE LEFT VENTRICLE
G. Ray, Southern University Agricultural & Mechanical College, Baton Rouge Campus, School of Engineering, Dept. of Mechanical Engineering, *Baton Rouge, Louisiana* 70813 (NCC 2-33)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0025, BIAXIAL FINITE DEFORMATIONS OF ARTERIAL AND VENOUS SEGMENTS UNDER PLUS OR MINUS GZ ACCELERATION STRESS
X.J. Avula, University of Missouri, Rolla Campus, School of Engineering, Dept. of Engineering Mechanics, *Rolla, Missouri* 65401 (DF055030; AFOSR-79-0107)

AF function - aircrew members operating high performance aircraft such as the F-15 and F-16 are exposed to increasing levels of rapid onset, long duration, repetitive g-forces. Data from USAFSAM and other research facilities indicate that the effects on the cardiopulmonary system may be the limiting factor in pilots' performance in air combat. A good physiological model of the cardiopulmonary system under g-stress is needed to provide human performance modelers the means to optimize combat tactics. Deficiency - the risk of actually exposing humans to high g-stresses to gain some knowledge of the cardiovascular system's response is prohibitive. The alternative is to develop a mathematical model and investigate its response to external excitations that are representative of various aircraft and spacecraft maneuvers. Objective - the objective of the proposed research is to determine radial and axial deformations of arterial and venous segments under dynamic fluid loads caused by blood pooling during GZ acceleration stresses of the aerospace environment. In an earlier model proposed by the investigator, only radial deformations were considered. Although it is reasonable to assume that only radial deformations are significant as a result of blood vessels being tethered to surrounding tissue, it is valid in the femoral-tibial region of the body where the blood vessels are embedded in a stiff muscular mass and under moderate accelerations. In the thoracic region, where the tissues surrounding the major vessels are relatively soft and accommodating, axial deformations of blood vessels can be significant. Also, under very high GZ stresses, even lower body blood vessels will deform in the axial direction. How research contributes - in designing a mathematical model of the cardiovascular system under acceleration stress, consideration of the large biaxial deformations of the blood vessels would contribute to the accuracy of the model.

In the proposed research, both radial and axial deformations of the arterial and venous segments under dynamic fluid loads will be treated from the standpoint of the large elastic deformation theory. The governing, nonlinear, partial differential equations will be solved numerically, and the blood pooling capacity of the arteries and veins will be determined for various realistic acceleration profiles.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0026, ASPECTS OF VISUAL SEARCH ACTIVITY RELATED TO ATTENTIONAL PROCESSES AND SKILL DEVELOPMENT
J.A. Stern, Washington University, School of Arts & Sciences, Dept. of Psychology, *4559 Scott Ave., St. Louis, Missouri* 63130 (DF055400; F49620-79-C-0089)

AF function - flying an aircraft involves critical decision-making based on visual information. Inasmuch as the eye is the sensing system for visual information, it would be profitable to analyze eye movements recorded in operational settings. Defi-

ciency - adequate data sources are not yet available which allow making inferences about the adequacy of a pilot's visual search activity and about state-dependent changes in a pilot's ability to take in and process visual information. Both adequacy of visual search in the alert pilot and change in the state of alertness affect performance. Objective - the research will identify momentary (phasic) and tonic changes in alertness and lapses of attention using eye movement parameters and relate periods of altered state to changes in performance, both decision-making and motor response. How research contributes - since operation of complex instrumentation involves periods of scanning and anticipation, measures like parameters of eye movements, which can be used to assess change of state during these periods, are more useful in operational conditions than measures of the outcome of performance. Defining periods during which performance decrements can be expected on the basis of the proposed ocular measures including eye blinks may be a more sensitive and useful approach since such measures can be obtained under operational conditions rather than being restricted to the laboratory, and allow corrective action to be taken before performance decrements significantly impair performance.

Three experiments will be conducted: (1) Determine the relationship between change in oculomotor indicants of fatigue and change in performance measures such as whether increased eye blink closure duration during one period is predictive of performance decrements in a subsequent period; (2) based on results in experiment I, determine the precise procedure using eye movement parameters to predict and reduce drop-outs in performance; and (3) further examine the test-retest reliability of the resulting ocular measures as indicants of fatigue in order to increase the generalizability of results. In experiments I and II a complex divided attention task simulating demands made on Air Force personnel will be performed. Experiment III will use a reading task, which is a well-practiced task allowing comparison of the test-retest reliability of the oculomotor indices. (Text Abridged)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0027, CONTROLLED ECOLOGY LIFE SUPPORT SYSTEM WORKSHOPS - THE BIOLOGICAL PROBLEMS AND EXPERIMENTAL PROGRAMS

B. Moore, University System of New Hampshire, University of New Hampshire, School of Technology, Dept. of Mathematical & Computer Science, *James Hall, Durham, New Hampshire* 03824 (NCC 2-27)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0028, TO DETERMINE THE RHYTHMICITY OF CIRCULATING CATECHOLAMINES IN NORMAL AND CHRONICALLY BED-RESTED SUBJECTS

B.H. Natelson, College of Medicine & Dentistry of New Jersey, New Jersey Medical School, School of Medicine, Dept. of Neurosciences, *100 Bergen St., Newark, New Jersey* 07103 (NCC 2-40)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0029, DETECTION, RECOGNITION, AND IDENTIFICATION OF TARGETS IN CIG DISPLAYS

M. Lemay, Montclair State College, School of Science & Mathematics, Dept. of Psychology, *Upper Montclair, New Jersey* 07043 (DF054920; AFOSR-79-0103)

AF function - this research supports the Air Force Flying Training Program, particularly simulator design efforts for electro-optical display training. Deficiency - new generation flight simulators are being equipped with computer image generation (CIG) displays designed to simulate electro-optical cockpit displays (infrared and low light level TV). Because CIG systems lack adequate capacity to reproduce all real world cues, it is necessary to know what to simulate to achieve effective training. The amount of display complexity needed to achieve this result is unknown. Objective - this research will attempt to determine the amount of display complexity needed to train three basic tasks using electro-optical displays - detection, recognition and identification of objects on the ground. How research contributes - the results of this research will add information to the knowledge base concerned with CIG simulation of electro-optical displays. It will impact the design of such simulations.

Three experiments will be conducted to estimate the minimum amount of display complexity necessary to perform detection, recognition, and identification of ground targets. Targets will be imbedded in a CIG scene created by scientists at AFHRL/AS, Wright-Patterson AFB, Ohio. The main independent variable will be the complexity of the scene. Targets will include a hangar, storage tank, water tower, house, office building and aircraft on the ground.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0030, THE INTERACTION OF METAL IONS AND NUCLEOTIDES - POSSIBLE MECHANISMS FOR THE ADSORPTION OF NUCLEOTIDES ON HOMOIONIC BENTONITE CLAYS

G.H. Loew, Rockefeller University, Lab. of Genetics, *66th & York Ave., New York, New York* 10021 (NCA 2-630901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0031, CHARACTERIZATION OF NON-BONDING MOLECULAR COMPLEXES BY EMPIRICAL ENERGY METHODS COUPLED TO THE AMES GRAPHICS SYSTEM

G.H. Loew, Rockefeller University, Lab. of Genetics, *66th & York Ave., New York, New York* 10021 (NCA 2-630902)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0032, NEUROSPORA EXPERIMENT

F.M. Sulzman, State University of New York, Albany Campus, Graduate School, *1400 Washington Ave., Albany, New York* 12203 (NAS 9-15975)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0033, MOTION SICKNESS IN THE CAT - CHEMICAL ASPECTS

G.H. Crampton, Wright State University, School of Science & Engineering, Dept. of Psychology, *Dayton, Ohio* 45431 (NCA 2-875002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0034, INVESTIGATION OF INHIBITION BY CAMP OF LYMPHOCYTE PLASMA MEMBRANE ENDOGENOUS PHOSPHORYLATION

R.E. Nordquist, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Anatomical Sciences, *Box 26901, Oklahoma City, Oklahoma* 73190 (NAS 9-15994)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Lyndon B. Johnson Space Center

6.0035, CENTRAL AND PERIPHERAL MECHANISMS UNDERLYING CARDIOVASCULAR DECONDITIONING IN THE UNANESTHETIZED PRIMATE

H.L. Stone, University of Oklahoma, Health Science Center, School of Medicine, Dept. of Physiological & Biophysics, *Box 26901, Oklahoma City, Oklahoma* 73190 (NCC 2-24)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

6.0036, COUNTER-CURRENT DISTRIBUTION OF BIOLOGIC CELLS
D.E. Brooks, Oregon State Higher Education System, University of Oregon Health Sciences Center, School of Medicine, Dept. of Neurology, *3181 S.W. Sam Jackson Park Rd., Portland, Oregon* 97201 (NAS 8-33575)

SUPPORTED BY U.S. National Aeronautics & Space Admin., George C. Marshall Space Flight Center

6.0037, ITEM DEVELOPMENT FOR AF READING ABILITIES TEST
D.A. Frucher, Educational Development Corp., *Austin, Texas* (DF233450; F33615-78-C-0038)

To develop items for additional forms of two levels of a reading test designed for use in classification of AF personnel.

360 items each of two subtest types and 600 items of a third type will be produced by the contractor in order to obtain 440 acceptable items, half for one level of the test and half for the other. The contractor will prepare a specimen set of 10 items of each subtype which will be reviewed and approved before preparation of remaining items. Subsequent groups of items will be placed in experimental booklets. Booklets will be administered to AF personnel, and AFHRL will also accomplish item analyses. Acceptable items will be placed on index cards as final products.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0038, INSTRUCTOR/SIMULATOR INTERFACE DESIGN STUDY
A. Lippay, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF228520; F33615-78-C-0006)

To develop and evaluate new design concepts for instructor interface in a flight simulator. The purpose is to provide a method of delineating instructional tasks to support analytic design and evaluation of interface methods, identify advanced methods as candidates for future systems, develop objective techniques for evaluating these methods, and apply the techniques to derive new design concepts for the instructor interface portion of future simulators.

A technique will be developed to delineate instructional tasks in a way which facilitates the design of interface concepts and equipment. Within the delineation framework so developed, a representative instructional task will be defined. A survey of interface methods will be conducted, and methods of promise will be matched with the instructional tasks for which they are best suited. Techniques will be derived for objectively evaluating interface methods and will be applied to several methods identified as best candidates. Results will be applied to develop advanced design concepts for instructor interface. Major milestones - delineation of instructor tasks (4 MAC), survey of interface methods (6 MAC), develop objective evaluation methods (10 MAC) and develop advanced design concepts (13 MAC).

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, NUMERICAL SOLUTION OF STEADY NAVIER-STOKES EQUATIONS
R.S. Schreiber, Stanford University, Graduate School, *Stanford, California* 94305 (NCA 2-745002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0002, NUMERICAL SOLUTION OF TRANSONIC FLOW PROBLEMS
S. Osher, University of California, Los Angeles Campus, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NCA 2-390002)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

7.0003, INTERCOMMUNICATIONS IN REAL-TIME, REDUNDANT, DISTRIBUTED COMPUTING SYSTEMS
H. Zanger, City University of New York, Queensborough Community College, Undergraduate School, Dept. of Electrical Technology, *56th & Springfield Aves., Bayside, New York* 11364 (NCA 2-625001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, THEORETICAL ASTROPHYSICS RESEARCH
P. Goldreich, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST78-21453)

Investigations related to a variety of outstanding astrophysical problems will be pursued. These include the excitation of density waves in galaxies by the potential of a central bar, the evolution of satellite orbits due to resonant tides raised in circumplanetary disks, the dynamics of supersonic turbulence in molecular clouds, the relation between quasar absorption lines and the clustering of galaxies, and the origin of the Kirkwood gaps in the asteroid belt.

This is a continuation of work being done under AST-7624281A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

8.0002, NUCLEAR PHYSICS AND RELATED RESEARCH IN ASTROPHYSICS, GEOPHYSICS AND TECHNOLOGY
T.A. Tombrello, California Inst. of Technology, Graduate School, Dept. of Physics Mathematics & Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (PHY76-83685 A01)

The research to be supported by this grant is in nuclear physics and related fields. It will be carried out in the Kellogg Radiation Laboratory, which has a history of significant contributions in these areas of research. The program covers many aspects of nuclear phenomena, particularly as they relate to stellar processes and how the geological and astronomical record of elemental and isotopic abundances can be analyzed to elucidate their production mechanisms. The research activities involve nuclear physics and experimental nuclear astrophysics, theoretical nuclear astrophysics, nuclear geophysics and planetary science, atomic physics, and applied nuclear physics. These areas are closely related, and there is considerable interaction between the projects.

This research is a continuation of that currently supported by Foundation grant PHY76-02724 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0003, HIGH RESOLUTION TRANSMISSION ELECTRON MICROSCOPE STUDIES OF SMALL METAL CRYSTALLITES AND SURFACES
K.H. Heinemann, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (NCC 2-30)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0004, AN INVESTIGATION OF THE PERFORMANCE, APPLICATION POTENTIAL, AND INHERENT LIMITATIONS OF THE NEW MICROANALYTICAL INSTRUMENT
K.H. Heinemann, Stanford University, School of Engineering, Dept. of Materials Science & Engineering, *Stanford, California* 94305 (NCC 2-46)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0005, ULTRA-HIGH RESOLUTION MOLECULAR BEAM CARS SPECTROSCOPY WITH APPLICATIONS TO PLANETARY ATMOSPHERIC MOLECULES
R.L. Byer, Stanford University, School of Humanities & Sciences, Dept. of Applied Physics, *Stanford, California* 94305 (NCC 2-50)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

8.0006, THEORETICAL HIGH ENERGY PHYSICS
J.M. Cornwall, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Physics, *405 Hilgard Ave., Los Angeles, California* 90024 (PHY7821502)

Research will be done in theoretical physics to further our understanding of the elementary particles, of quantum field theory, and of many-body theory. Topics will include: 1) Broken chiral invariance; 2) Confinement and quantum chromodynamics; 3) Dynamical symmetry breaking; 4) Gauge theory, applied especially to the strong interactions; 5) Relativistic many-body theory; 6) Descriptions of the weak interactions alternative to the Salam-Weinberg-GIM model; 7) Neutral currents; 8) Phenomenology; 9) Supersymmetry.

This work is a continuation of that currently supported under NSF Grant PHY76-23467 A02, and this award will be the first year of a two-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0007, THE ELECTRIC CURRENT STRUCTURE OF THE MAGNETOSPHERE AND HELIOSPHERE
H. Alfven, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (ATM77-12866 A01)

This grant continues studies of the current system in natural plasmas, paying attention to those effects which produce non-ideal plasma behavior, examination of the conditions for the production of charge double layers, and the collapse of volume currents into sheets and filaments. These phenomena will be related to magnetospheric observations.

A separate but related study of filamentation in the solar corona and chromosphere, in the solar wind, and in the tails of comets will be undertaken. The overall aim is to seek the consequences of these effects on solar-terrestrial relations.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0008, SPECTROSCOPY OF CONDENSED MATTER SYSTEMS
S. Schultz, University of California, San Diego Campus, Graduate School, Dept. of Physics, *P.O. Box 109, La Jolla, California* 92037 (DMR77-14659 A01)

This research program is a continuation and extension of work initiated under grant DMR-7424361. The relatively new tool of fluctuation spectroscopy will be used to aid in a determination of the dynamical properties of a variety of condensed matter systems which are extremely difficult to measure by alternative techniques. Applications range from the rate constants in simple chemical kinetics to the conformational chemisorption, and to 1/f noise. Another topic of this research program will be the investigation of crystallization processes. Experiments relating to the EPR and ENDOR of biomolecules will be carried out also.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0009, INNER-SHELL EXCITATIONS IN HEAVY ION-ATOM COLLISIONS
Q.C. Kessel, University of Connecticut, Storrs Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Storrs, Connecticut* 06268 (PHY78-06723)

A comprehensive experimental study of the excitation of inner electron shells in heavy atoms during high-energy ion-atom collisions will continue. This investigation will shed light on the quasi-molecular processes (in particular, curve crossing phenomena) which occur at small internuclear separations. These small internuclear separations can only be achieved by high-energy collision processes. The techniques which have been applied in the investigations include both coincidence and scattered particle measurements of the inelastic energy loss, the determination of scattered charge states and the measurement of relative cross-sections for X-ray emission. New experiments will provide detailed information on the couplings which give rise to diabetic molecular orbitals in very heavy ion-atom collisions. The results will be compared with the model of Fano and Lichten, with extensions of this model by Barat, Lichten, Eichler and co-workers, and with predictions of recent theoretical work by Schmid and Garcia.

This is a continuation of work currently supported by NSF Grant PHY76-10352 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0010, SELECTIVE PHOTOEXCITATION OF MOLECULES
W.C. Rhodes, State University System of Florida, Florida State University, Inst. of Molecular Biophysics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (CHE76-80292 A01)

These studies deal with the nature of time-dependent radiative and radiationless processes in molecules, which are associated with absorption of light having various spectral properties (in particular those of laser pulses). There are two major areas. The first deals with the excitation of molecules having dense manifolds of excited states, as for aromatic hydrocarbons. Specific topics to be studied are (1) the composition of the prepared excited state in terms of both molecular eigenstates and the more conventional Born-Oppenheimer state; (2) the extent to which the light acts as a projector on regions of the absorption spectrum; (3) the analysis of the absorption spectrum in terms of the interaction density (effective density of states) function and the associated excited state coupling schemes; and (4) spectroscopic criteria for oscillatory versus dissipative time-dependent behavior of excited states. The second major area is concerned with the coherent, nonlinear response of molecules to laser light. Particular focus will be placed on the coherent nature of vibrational excitation associated with infrared laser photochemistry being studied in other laboratories.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0011, MOLECULAR PHYSICS AND CHEMISTRY BASIC TO ENVIRONMENTAL RESEARCH
J.L. Dehmer, U.S. Dept. of Energy, Argonne National Lab., *9700 S. Cass Ave., Argonne, Illinois* 60439 (ANL 67102; ERDA RK-02-04-01)

The underlying concept of this theoretical program is to elucidate the fundamental electronic properties of pollutant molecules (and related molecules) and thereby to contribute to the sound understanding of their physical and chemical interactions in man's environment.

SUPPORTED BY U.S. Dept. of Energy

8.0012, ELECTRONIC STRUCTURE AND TRANSPORT PROPERTIES OF SEMICONDUCTING POLYMERS
A.B. Kunz, University of Illinois, Urbana Champaign Campus, School of Liberal Arts & Sciences, Dept. of Physics, *Urbana, Illinois* 61801 (DF056370; F49620-79-C-0215)

AF function - this proposed research primarily falls in the 7.4 research objectives which deal with the theoretical and experimental investigations of electronic, optical, acoustic, thermal, magnetic and conducting properties of materials to evolve new and improved device concepts. In particular, the theoretical investigations of excitonic superconductors which have high temperature transitions will lead to a quantum jump forward in the development of electronic devices. Deficiency - a wide range of basic research efforts that support the development of devices and device concepts are needed for the application of contemporary electronic electromagnetic technology in the operational Air Force. Most studies of superconductors have investigated low transition temperature systems. Objective - the major emphasis is to investigate the excitonic mechanism in the most likely systems to be useful to AF needs. The logical candidates would include the semiconducting polymers. Contribution - this research is a part of a comprehensive program in statistical mechanics to study phase transitions.

The main goal of this research is to produce a series of electronic band studies for silicon-based polymers and if time permits carbon-based polymers. These investigations will be studied to identify these polymers or classes of polymers most likely to favor the establishment of excitonic mechanisms for superconductivity. Investigations of donor levels caused by replacing polymer subgroups with alternate ones and mechanisms of ionizing these donors into the conduction band will be done. The coupling of these donor electrons to the exciton field of the polymer is to be computed and estimates of possible superconducting transition temperatures obtained.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0013, X-RAY STUDIES OF SOLID-STATE PROBE TIES - VALENCE CHARGE DENSITIES - ACOUSTOELECTRICALLY AMPLIFIED PHONONS
R. Colella, Purdue University, School of Science, Dept. of Physics, *Executive Bldg., West Lafayette, Indiana* 47907 (PRF 0228)

X-ray diffraction techniques are being applied for investigating nonequilibrium phonons in crystals produced by AcoustoElectric (A.E.) amplification. Intense phonon beams of one well defined branch (Fast Transverse) can be generated in crystals by means of the A.E. effect, with frequencies of the order of 10 to the 9th power Hz. The time evolution of the acoustic flux generated by the A.E. effect has been investigated. An elaborate technique for recording diffraction patterns in the time-resolved mode with a resolution of 0.5 micron per second has been recently implemented. Experiments are in progress for investigating lifetimes of A.E. phonons and nonlinear interaction processes during their decay. Our data clearly show the effect of frequency down-shift when phonon domains bounce off the walls and reverse their direction of propagation. Work is in progress to repeat in the time-resolved mode some previous experiments on anomalous transmission of X-rays in which forbidden modes were observed. The idea is to see whether or not these forbidden modes arise from bouncing off the walls, or whether they are present in the primary propagating domain.

SUPPORTED BY Purdue Research Foundation

8.0014, THEORIES OF QUARKS AND LEPTONS
T. Cheng, University of Missouri, St. Louis Campus, School of Arts & Sciences, Dept. of Physics, *8001 Natural Bridge Rd., St. Louis, Missouri* 63121 (PHY78-08427)

The proposed work is in the area of theoretical physics, and suggests study of various problems in elementary particle interactions. It is becoming increasingly plausible that modern gauge theories provide the correct theoretical framework in which to describe such elementary particle reactions. The present work will study the possibility of a natural link between dynamics and various approximate symmetries observed in nature using some particular features of the fermion mass matrices-Majorana mass terms which violate lepton number conservation; non-diagonal terms which bring about fermion- and lepton-mixing, etc. The possibilities of massive neutrinos and massless u-quarks will also be examined.

This is a continuation of research currently supported under NSF grant PHY76-09798 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0015, AURORAL ELECTRON INTERACTIONS
R.L. Kaufmann, University System of New Hampshire, University of New Hampshire, School of Technology, Dept. of Physics, *James Hall, Durham, New Hampshire* 03824 (ATM77-01014)

This grant will extend the use of magnetometer and energetic particle data to investigate several problems associated with auroral electron acceleration and magnetohydrodynamic wave generation. A number of university groups will be working on various aspects of these topics, particularly during the International Magnetospheric Study period. The effort supported here will make a significant contribution to this worldwide effort. First priority is to fully utilize Dr. Arnoldy's rocket measurements of the auroral electron distribution function. These data will allow a study of the stability properties of the auroral plasma at rocket altitudes. When the plasma is unstable, it is possible to determine which wave mode should grow most rapidly. More frequently the plasma is just barely stable. At such times, a similar analysis will show which wave modes were unstable at higher altitudes. The waves presumably modified the electron distribution function through nonlinear processes until it reached the observed marginally stable state. These calculations should provide a good test of several aspects of plasma stability theory. In this sense, the work will represent one important step in attaining the goal of utilizing the magnetosphere as a plasma physics laboratory. The overall aim is to understand auroral precipitation.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Atmospheric Sciences

8.0016, PROBLEMS IN RENORMALIZATION
E.R. Speer, Rutgers the State University of New Jersey, New Brunswick Campus, School of Arts & Sciences, Dept. of Mathematics, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (PHY77-02277 A01)

Research will be done in theoretical physics to further our understanding of the elementary particles. Work will focus on several problems connected with renormalization in quantum field theory. Quantum field theory is the theoretical framework which is the basis for practically all our efforts to understand elementary particles. Renormalization is a mathematical technique which greatly enhances our ability to use theory. The problems to be addressed here include definition of distributions in complex dimension, light cone expansions, the application of analytic renormalization methods to constructive quantum field theory, and the characterization of those renormalizations which alter minimally the structure of the field theory to which they are applied.

This work is a continuation of that currently supported under NSF grant PHY77-02277.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0017, ENERGY TRANSFER MECHANISMS IN MATERIALS STUDIED BY ULTRAFAST LASER TECHNIQUES
R.R. Alfano, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (ENG76-80212)

A research program will investigate intermolecular energy transfer between donor and acceptor molecules in liquids and solids using ultrafast laser spectroscopy. The program encompasses a systematic study of measuring the fluorescence and absorption kinetics from the different molecular components after optical excitation of one molecular component by picosecond laser pulses. Fluorescence kinetics from upper singlet states will be studied. Organic dyes mixtures in solvent and doped organic crystals at diff-rent concentration of donors and acceptor molecules will be investigated to determine the mechanisms for energy migration between donor molecules and between donor and acceptor molecules. The temperature and viscosity dependence will be studied to yield this information. The energy transfer along long donor molecule chains will be studied. The characterization of energy migration of excited states in solids and liquids is important in the understanding on how to transfer optical energy to different spectral regions.

SUPPORTED BY U.S. National Science Foundation, Directorate for Engineering & Applied Science, Div. of Chemical & Process Engineering

8.0018, RESONANCES UTILIZING MULTIPARTICLE SPECTROMETERS
S.J. Lindenbaum, City University of New York, City College, School of Liberal Arts & Sciences, Dept. of Physics, *Convent Ave. & 138th St., New York, New York* 10031 (PHY77-20225)

Investigations of the production of resonance states in hadron-proton collisions will be conducted in collaboration with research groups from Brookhaven National Laboratory, Brandeis, Massachusetts, and Cincinnati using the multiparticle spectrometer at the Brookhaven Alternating Gradient Synchrotron.

The program consists of two parts: 1. Search for charm particle production. This experiment, if successful, would demonstrate associated charm particle production and would show that selection rules for charm and strangeness quantum numbers are similar. Fifteen to 20 GeV pi meson interactions in hydrogen are studied. 2. Search for additional conventional resonances in the 1 to 3 GeV mass range. This experiment explores with high statistics the many particle final states in the energy range of 1 to 3 GeV produced in 6 GeV K-interactions in hydrogen.

This work represents a continuation of that currently supported by Foundation grant PHY73-04384 A02.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0019, ELECTRON SPECTROSCOPY OF NEGATIVE IONS
J.S. Risley, University of North Carolina, North Carolina State University, School of Physical & Mathematical Sciences, Dept. of Physics, *Raleigh, North Carolina* 27607 (PHY78-02384)

This study in atomic physics is concerned with the fundamental structure of autodetaching, excited states of negative ions, using the ion-atom collisional technique of exciting the negative ion state and electron spectroscopy to detect the decay. A new experimental apparatus is planned which will allow us to measure, with higher accuracy than any previous attempt, the positions and widths for many autodetaching states of negative ions (most importantly H) and autoionizing states of atoms and positive ions through the use of high-resolution spectrometers whose surfaces will be coated with polycrystalline molybdenum coupled with a calibration scheme using ultraviolet laser-produced photoelectrons. Intensity measurements of some lines will yield new information about the branching ratios or relative transition probabilities for the excited states.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0020, THEORETICAL ELEMENTARY PARTICLE PHYSICS
R.W. Brown, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (PHY78-08883)

Of paramount importance in element particle theory is the question of the existence of the intermediate vector bosons, the carriers of the weak interaction force. Whether or not interactions other than quantum electrodynamics can be described via a field theory is at the heart of the new gauge theories. The success and self-consistency of these gauge theories in turn promises that weak bosons ought to exist and that they should have masses in the 30 to 100 GeV/c2 range, a range which can be explored with the next generation of high-energy accelerators.

The updating and extension of theoretical predictions for the production rates relevant to the very high energies of the future is thus quite important at this time and is the subject of the proposed research.

This work is a continuation of that currently supported under NSF grant PHY76-12245 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0021, THEORETICAL STUDIES ON VARIOUS COMPOSITE PARTICLE SYSTEMS
L.L. Foldy, Case Western Reserve University, School of Science, Dept. of Physics, *2165 Adelbert Rd., Cleveland, Ohio* 44106 (PHY78-11629)

The work is in the field of theoretical physics, with emphasis on attempting to understand the interactions of elementary particles with nuclei. Particular projects which will be studied are in the areas of: A) Multiple Scattering Theory - 1) target particle binding effects; 2) intrinsic multiple scattering. B) Separable and Non-local Potentials. C) Coulomb Lattices. D) Relativistic Particle Systems. E) Miscellaneous Problems. 1) Gauge variance of observables; 2) Phenomenology of exchange currents in nuclei; 3) Ramsauer effect; 4) Quantum mechanics on various manifolds; 5) Properties of special classes of random matrices.

This work is a continuation of that currently supported under NSF grant PHY76-00299 A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Mathematical & Physical Sciences, Div. of Physics

8.0022, INVERSE SCATTERING - IONOSPHERIC STRUCTURE DETERMINATION
J.M. Cohen, University of Pennsylvania, School of Arts & Sciences, Dept. of Physics, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (DF055770; F49620-79-C-0127)

AF function - radio communication and control. Opportunity - a newly developed method for data processing seems applicable to ionospheric probing. Objective - real-time measurement of F layer irregularities. How work contributes - layering characteristics of ionosphere will aid development of optimized modulation and diversity schemes for propagating radio waves.

Present ray-based algorithms for ionospheric probing give approximate information only about the near side of peaks in index of refraction. Newly developed wave-based inverse scattering techniques seem capable of determining the far side of the peak as well. Amplitude and phase data versus frequency for vertical propagation will be obtained on a quiet day near the magnetic equator. A definite variational principle for the Gelfand Levitan equation will be used to construct and obtain error bounds for the variation of index refraction in the F layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

8.0023, MULTICOLOR LIDAR SYSTEM RESEARCH
G.E. Copeland, Old Dominion University, School of Sciences & Health Professions, Dept. of Physics & Geophysical Science, *P.O. Box 6173, Norfolk, Virginia* 23508 (NCC 1-32)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Langley Research Center

8.0024, PROPERTIES OF LIQUID HELIUM FOUR
G.B. Hess, University of Virginia, School of Arts & Sciences, Dept. of Physics, *Garrett Hall, Charlottesville, Virginia* 22903 (DMR78-10778)

By studying the amplitude dependence of the resonant frequency of a Helmholtz resonator in the regime of vortex-free superfluid flow, the experimental observation has been made of the dependence of the superfluid density on the difference between the superfluid and normal fluid velocity. A systematic study of this dependence will be made, with emphasis on the region near the transition temperature where there are problems with the theory of the superfluid density. This work is important for understanding the hydrodynamics of quantum fluids.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Materials Research

8.0025, QUANTUM THEORY OF REACTIVE, DISSOCIATIVE AND INELASTIC MOLECULAR SCATTERING
K. Tang, Pacific Lutheran University, School of Arts & Sciences, Dept. of Physics, *P.O. Box 2068, Tacoma, Washington* 98447 (CHE78-09808)

Professor Tang's grant is for research in the quantum chemical area of atom-molecule scattering. The fundamental process occurring in chemical reactions is the collision between atoms and/or molecules of reagents, with subsequent rearrangement of chemical bonds to form products. Tang's group will seek to develop a polarized target coupling method for three-dimensional reactive, dissociative, and inelastic molecular scattering. This work will be an extension of the adiabatic distorted wave model already developed by Tang and others. By relaxing the adiabatic assumption, it will become possible to treat reactive scattering processes with small or no activation barriers. Convergence of results will be tested in a systematic way, and formal aspects of the theory will be studied. Attention will be focussed on reactions involving hydrogen isotopes, because of their fundamental theoretical interest, and on reactions involving hydrogen halides, because of their importance in laser applications. Calculations on cross-sections of ion-molecule collisions will be carried out in order to shed light on the process of vibrational enhancement of reaction rates. Similar techniques will be used to investigate ways to predict the outcome of dissociative scattering processes, as well as to develop efficient quantum methods for calculating inelastic cross-sections for vibrational-translational-rotational energy transfer.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Mathematical & Physical Sciences, Div. of Chemistry

8.0026, STUDIES ON BIOLOGICAL SYSTEMS WITH EXTENDED X-RAY ABSORPTION FINE STRUCTURE
E.A. Stern, University of Washington, School of Arts & Sciences, Dept. of Physics, *Seattle, Washington* 98105 (OCE77-02872 A01)

The atomic structure of several biological systems will be studied using the extended X-ray absorption fine structure (EXAFS) technique. The systems chosen are ones which have current biological interest and are particularly suited for analysis by EXAFS. By such analysis it is hoped to answer questions concerning these systems that would be difficult if not impossible to answer otherwise. EXAFS can determine the atomic arrangement in the vicinity of a given type of atom, and can do so whether the sample has long range order or not. EXAFS will be applied to metalloproteins to study the environment of the metal as a function of the state of the protein. Such EXAFS studies can be made in configurations more closely approximating the natural state than can be done with conventional crystallography. Among the proposed proteins to be studied are rubredoxin, cytochrome-c, photosynthetic reaction center, carboxypeptidase A, and blood coagulation factors.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Physiology Cellular & Molecular Biology

SOCIAL SCIENCES

Includes Social Sciences (general); Administration and Management; Documentation and Information Science; Economics and Cost Analysis; Law and Political Science; and Urban Technology and Transportation.

9.0001, ANALYSIS OF LAND USE PRACTICES AND POLICIES FROM LANDSAT DATA
C.W. Fennell, University of Georgia, School of Liberal Arts, Dept. of Geography, *Athens, Georgia* 30601 (SOC77-27701)

Information related to land use/land development projects of modern China is largely limited to government and visitor reports which seldom indicate spatial distributions or provide solid data by which the success (or failure) of planning policies can be measured. This research will employ recent LANDSAT-1 and -2 satellite image data in conjunction with supplementary information to map, analyze and compare the urban and rural land use patterns in seven selected regions of China known to have undergone significant change since 1949. Specifically, the study areas include: (a) Northeast and Borderlands; (b) North China Plain; (c) Huang Ho Basin; (d) Central Yangtze and Lakes Basin; (e) Pearl River Delta; (f) Sinkiang; and (g) Tibet. LANDSAT data and supplementary maps, photographs and reports are available for these study areas and previous investigations by the authors have demonstrated the feasibility of conducting regional land use studies of China from satellite data. It is anticipated that the regional studies and interregional comparisons will permit an objective assessment of Chinese planning goals and achievements.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Biological Behavioral & Social Sciences, Div. of Social & Economic Science

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, DIRECT DETERMINATIONS OF THE DYNAMICAL STRUCTURE AND CHEMICAL COMPOSITIONS OF LOCAL GROUP ELLIPTICAL GALAXIES
H.C. Ford, University of California, Los Angeles Campus, School of Letters & Science, Dept. of Astronomy, *405 Hilgard Ave., Los Angeles, California* 90024 (AST76-21312 A01)

The isolation and study of planetary nebulae are the only present means of directly determining the characteristics of the old stellar populations in galaxies of the Local Group. These characteristics include chemical composition (which gives data on nucleosynthesis in sequential generations of stars) and kinematics (which allows a detailed investigation of the dynamical structure of the galaxies in which the planetaries are found). Precision coordinates for 370 planetary nebulae in the Andromeda galaxy and its companions have been determined. Radial velocities of planetaries in M31 will be used to investigate the dynamical structure of its nuclear bulge. Reduction and analysis of radial velocities already obtained in M32, NGC 205, and M31 will be carried out. A novel technique of using a temperature and tilt controlled 1.5 angstrom bandpass interference filter to take velocity modulated photographs will be used to determine the radial velocities of large numbers of planetaries near and to within 15 parsecs of the nucleus of M31. The Kitt Peak National Observatory (KPNO) Image Tube Image Dissector Scanner on the Mayall 4-m telescope will be used to make spectrophotometric observations of planetary nebulae in NGC 147, M32, and NGC 205. The observations will allow the first direct chemical composition determinations in these galaxies and the data on the abundances will be fundamental for understanding metal enrichment during the formation of galaxies.

This is a continuation of research done under grant AST 76-21312.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0002, COMPARISON OF CALCULATED AND OBSERVED PROPERTIES OF COLLAPSING PROTOSTELLAR GAS CLOUDS
P.H. Bodenheimer, University of California, Santa Cruz Campus, Graduate School, Dept. of Astronomy & Astrophysics, *Santa Cruz, California* 95060 (NCA 2-690001)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Ames Research Center

10.0003, AN OBSERVATIONAL INVESTIGATION OF THE NATURE AND EVOLUTIONARY STATUS OF THE RS CANUM VENATICORUM ECLIPSING BINARY STARS
F.B. Wood, State University System of Florida, University of Florida, School of Arts & Sciences, Dept. of Astronomy, *208 Tigert Hall, Gainesville, Florida* 32601 (AST76-17591 A01)

The RS Canum Venaticorum eclipsing binary stars present many interesting problems relative both to stellar structure and to stellar and binary evolution. A program of continued systematic observation of the light curves of these stars will be carried out. Emphasis will be placed on understanding the structure and evolutionary status of these stars by carefully analyzing light curves and the changes in these light curves. Photoelectric photometry will be carried out using the 18- and 30-inch telescopes of Rosemary Hill Observatory (University of Florida) and the 24-inch telescopes of Mount John University Observatory (Universities of Canterbury, Pennsylvania, and Florida) in New Zealand. A spectroscopic survey for new examples of the class in the southern hemisphere will be undertaken at Mount John.

Prior support was under NSF Grant AST 76-17591.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0004, MAUNA KEA OBSERVATORY 2.25M TELESCOPE CONTROL SYSTEM
T.B. McCord, University of Hawaii System, Manoa Campus, Inst. for Astronomy, *2840 Kolowala St., Honolulu, Hawaii* 96822 (AST76-81951 A02)

This grant will provide funds for completion of a new control system for the Mauna Kea Observatory of the University of Hawaii. The 88-inch telescope was designed and built in the 1960's and was delivered to the Institute of Astronomy of the University of Hawaii in 1970. The telescope has been in constant use since installation and is mechanically and optically sound. There have, however, been continuing problems with the telescope's electrical and electronic systems. Observing techniques and technology have advanced considerably since the telescope was designed, and the original design is now obsolete. It is now time to rebuild the telescope's electrical and electronic systems in order to make efficient use of this facility.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0005, STUDIES OF NEARBY LUMINOUS STARS IN GALAXIES
R.M. Humphreys, University of Minnesota, Minneapolis Campus, School of Liberal Arts, Depts. of Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (AST78-18398)

In recent years, the most luminous supergiants have become important steps in the determination of the extragalactic distance scale. However, very little fundamental information is available for these important stars, particularly outside our own galaxy. The primary purpose of this research is to obtain basic data, including spectra, for classification and photometry of individual stars in the Local Group galaxies. These observations have application to a number of current problems, including the cosmic distance scale and the progress of stellar evolution in different galaxies. These and other questions will be studied. In addition to observations of individual stars in the nearest galaxies, some aspects of the properties of the Population I stars such as the blue to red supergiant ratio can be studied in more distant spirals.

This research program is a continuation of AST76-09082A01.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0006, ANALYSIS OF SOLAR WIND VELOCITY - INTERNATIONAL SOLAR POLAR MISSION
E.P. Moore, New Mexico Inst. of Mining & Technology, Graduate School, Dept. of Physics, *Campus Station, Socorro, New Mexico* 87801 (NCA 5-81)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Goddard Space Flight Center

10.0007, STUDIES OF MAGNETIC PECULIAR A STARS
S.J. Adelman, Citadel Military College of South Carolina, Graduate School, *Charleston, South Carolina* 29409 (AST78-25395)

This research will be concerned with observational and theoretical studies of the sharp-lined magnetic Ap stars. These stars are known to have large surface magnetic fields and peculiar chemical abundances. Spectroscopic and spectrophotometric observations of these stars will be used for line identifications and abundance analysis studies. A study will be made of how magnetic fields in these stars affect the observed properties of the stars. Models of chemically inhomogenous atmospheres will be computed and the observational predictions of such models will be compared with actual observations. The evolution of an Ap star will be computed in order to determine the physical parameters that affect the atmospheres of these stars.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0008, RAPID OPTICAL VARIATIONS FROM COMPACT STARS
R.E. Nather, University of Texas, Austin Campus, School of Natural Sciences, Dept. of Astronomy, *200 W. 21st St., Austin, Texas* 78712 (AST76-23882 A01)

A program of observations of rapid periodic luminosity variations in white dwarfs will be extended to include other aspects of rapid optical variations from compact objects. Photometric observations will be made of non-periodic variations (with time scales between a few milliseconds and a few minutes) of white dwarf stars and their accretion disks in nova and nova-like variables. Observations will also be made of the periodic optical variations produced by neutron stars in radio pulsars and binary X-ray pulsars. The observational techniques will be extended to include high-speed spectroscopy as well as high-speed photometry. These observations will be carried out in order to obtain information on the observational characteristics of the rapid optical variations of these objects, on the physical mechanism producing the rapid variations, and on the structure of the compact objects.

This is a continuation of work previously supported under NSF Grant AST 76-23882.

SUPPORTED BY U.S. National Science Foundation, Directorate for Astronomical Atmospheric Earth & Ocean Scis., Div. of Astronomical Sciences

10.0009, INFRARED STUDIES OF INTERSTELLAR AND CIRCUMSTELLAR MATERIALS
J.A. Hackwell, University of Wyoming, School of Arts & Sciences, Dept. of Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (AST77-07505 A01)

The composition and distribution of dust in space and the effect on the dust of its environment, for example, the radiation field, the gas density and the degree of ionization, will be studied using infrared astronomy techniques. The goal is to determine to what extent the dust observed in ionized hydrogen

(HII) regions, in 'cold' interstellar space, and around late-type stars is related.

Dust in HII regions will be studied by making maps in the 8-13 micron and 16-25 micron spectral regions using array spectrometer systems developed at Wyoming and mounted on the University of Wyoming's 2.3-meter (92-inch) infrared telescope. Infrared line observations of HII regions will be made, particularly in heavily observed regions, to determine excitation conditions in the nebula. An indium-antimonide (InSb) system will be used to make sensitive 1-5 micron observations of line strengths and free-free emission in selected regions. The observations of dust in HII regions will be compared with measurements of infrared interstellar absorption bands and with spectral features observed in late-type stars and other heavily obscured objects.

The scheduling flexibility of the 2.3-m telescope will allow the study of dust formation in such transient events as novae when they occur. These studies will help us to understand dust formation mechanisms in other objects.

This is a continuation of work previously supported by NSF grant AST77-07505.

SUPPORTED BY U.S. National Science Foundation,
Directorate for Astronomical
Atmospheric Earth & Ocean Scis., Div.
of Astronomical Sciences

GENERAL

11.0001, SUPPORT OF CONFERENCE PLANNING FOR INTERNATIONAL SOCIETY FOR SPACE BIOLOGY

J.O. Kessler, University of Arizona, School of Liberal Arts, Dept. of Physics, *Tucson, Arizona* 85721 (NAS 9-16015)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Lyndon B. Johnson Space Center

11.0002, JOINT USE OF RESOURCES FOR OPERATION OF NASA-AMES CONSORTIUM OFFICE

L. Eisenberg, California State University & Colleges, San Francisco State University, Graduate School, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660001)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

11.0003, TARGET SEARCH FOR EXTRA-TERRESTRIAL INTELLIGENCE OBSERVATIONS USING VERY LONG BASE INTERFEROMETRY TECHNIQUES & PATTERN RECOGNITION STUDIES

W.J. Welch, University of California, Berkeley Campus, School of Engineering, Dept. of Electrical Engineering, *Berkeley, California* 94720 (NCC 2-36)

SUPPORTED BY U.S. National Aeronautics & Space Admin.,
Ames Research Center

11.0004, WIND TUNNEL SIMULATIONS OF MARTIAN SAND STORMS

R. Greeley, University of Santa Clara, School of Science, *El Camino Rd., Santa Clara, California* 95053 (NCC 2-60)

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Ames Research Center

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01 AERONAUTICS (GENERAL)

N80-23249* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

CONCEPTUAL STUDIES OF A LONG-RANGE TRANSPORT WITH AN UPPER SURFACE BLOWING PROPULSIVE LIFT SYSTEM

John A. Cochrane May 1980 24 p

(NASA-TM-81196; A-8169) Avail: NASA. Ames Res. Center, Moffett Field, Calif. 94035 CSCL 01C

The application of propulsive lift technology to the long range, heavy lift transport mission was studied. The level of propulsive lift technology studied was that which is represented by the Quiet Short-Haul Research Aircraft (QSRA). This technology uses the upper surface blowing technique (USB) to develop high lift coefficients. Results indicate that field lengths of less than 3000 ft are feasible at landing gross weights and that even at maximum takeoff gross weight, a reduction in field length is available as compared to a conventional aircraft. Further study of the concept is recommended. J.M.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer*.

N80-23250*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LEEWARD FLOW OVER DELTA WINGS AT SUPERSONIC SPEEDS

Joachim G. Szodruch Apr. 1980 49 p refs

(NASA-TM-81187; A-8117) Avail: NTIS HC A03/MF A01 CSCL 01A

A survey was made of the parameters affecting the development of the leeward symmetric separated flow over slender delta wings immersed in a supersonic stream. The parameters included Mach number, Reynolds number, angle of attack, leading-edge sweep angle, and body cross-sectional shape, such that subsonic and supersonic leading-edge flows are encountered. It was seen that the boundaries between the various flow regimes existing about the leeward surface may conveniently be represented on a diagram with the components of angle of attack and Mach number normal to the leading edge as governing parameters. R.E.S.

N80-23251*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STUDY OF PANEL LOADS AND CENTERS OF PRESSURE OF THREE DIFFERENT CRUCIFORM AFT-TAIL CONTROL SURFACES OF A WINGLESS MISSILE FROM MACH 1.60 TO 3.70

Milton Lamb and Charles D. Trescot, Jr. May 1980 112 p refs

(NASA-TM-81787; L-13501) Avail: NTIS HC A06/MF A01 CSCL 01A

An investigation was made of the forces and moments on the cruciform aft-tail control surfaces of a wingless missile model to determine the variation of panel load and center of pressure with angle of attack, tail deflection, model roll angle, and Mach number. Also, a limited force-moment and surface-pressure investigation was made on a noncircular aft end. These investigations were made in a unitary plan wind tunnel at Mach numbers of 1.60, 2.36, and 3.70 and at a Reynolds number per meter of 6,600,000. The cruciform aft-tail results indicate very little variation in the center of pressure for the highly loaded windward tail. The noncircular aft-end test results indicate no significant effect of the fin unporting on the fin loads. R.E.S.

N80-23252*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.

SURFACE PRESSURE MEASUREMENTS AT TWO TIPS OF A MODEL HELICOPTER ROTOR IN HOVER Final Report

R. B. Gray, H. M. McMahon, K. R. Shenoy, and M. L. Hammer May 1980 46 p refs

(Contract NAS1-15158; DA Proj. 1L1-61102-AH-45A)

(NASA-CR-3281) Avail: NTIS HC A03/MF A01 CSCL 01A

Surface pressures were measured near the tip of a hovering single-bladed model helicopter rotor with two tip shapes. The rotor had a constant-chord, untwisted blade with a square, flat tip which could be modified to a body-of-revolution tip. Pressure measurements were made on the blade surface along the chordwise direction at six radial stations outboard of the 94 percent blade radius. Data for each blade tip configuration were taken at blade collective pitch angles of 0, 6.18 and 11.4 degrees at a Reynolds number of 736,000 and a Mach number of 0.25 both based on tip speed. Chordwise pressure distributions and constant surface pressure contours are presented and discussed. Author

N80-23253*# National Aeronautics and Space Administration, Washington, D. C.

LEE SIDE FLOW FOR SLENDER DELTA WINGS OF FINITE THICKNESS

Joachim G. Szodruch Mar. 1980 161 p refs Transl. into ENGLISH of "Leeseiten-Stroemung Bei Schlanken DeltaFluegeln endlicher Dicke" Rept. ILR-23 Tech. Univ., Berlin, Inst. fuer Luft und Raumfahrt, 1977 150 p Trans. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75753; ILR-23) Avail: NTIS HC A08/MF A01 CSCL 01A

An experimental and theoretical investigation carried out to determine the lee side flow field over delta wings at supersonic speeds is presented. A theoretical method to described the flow field is described, where boundary conditions as a result of the experimental study are needed. The computed flow field with shock induced separation is satisfactory. M.G.

N80-23254# Nielsen Engineering and Research, Inc., Mountain View, Calif.

ACTIVE CONTROL OF ASYMMETRIC VORTEX EFFECTS Final Technical Report, 20 Apr. 1978 - 20 Dec. 1979

John E. Fiddler Dec. 1979 55 p refs

(Contract N60921-78-C-0073; WR02303003)

(AD-A081648; NEAR-TR-212) Avail: NTIS HC A04/MF A01 CSCL 20/4

Active control of asymmetric vortex effects on a pointed, slender body at high angles of attack has been achieved by rotating portions of the body about the axis. The lee side asymmetric vortex patterns and their associated yaw-plane forces and moments have been varied in cyclic, repeatable fashion at rates up to 100 cycles per second. The variations occurred to rapidly that the average yaw-plane quantities were brought to small, steady values, or nulled out. The effect was obtained by rotating the nose, the nosetip and a band of the body surface just aft of the nose. GRA

N80-23255# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

NUMERICAL FLOW FIELD PROGRAM FOR AERODYNAMIC HEATING ANALYSIS. VOLUME 1: EQUATIONS AND RESULTS Final Technical Report, Jun. 1977 - Sep. 1979

H. J. Fivel Wright-Patterson AFB, Ohio AFFDL Dec. 1979 125 p refs

(Contract F33165-77-C-3003; AF Proj. 2404)

(AD-A081471; AFFDL-TR-79-3128-Vol-1) Avail: NTIS HC A06/MF A01 CSCL 20/4

This report documents a study to modify an existing computer program which provides an economical and easy to use analytic tool for aerodynamic heating to a wide variety of 3 dimensional vehicle configurations. This report also serves as a user's manual for the computer program plus two auxiliary programs written to analyze vehicle geometry, and presents program capabilities, input/output characteristics, and example problems. Core requirements have been minimized by the use of overlays. User oriented features of the program include minimized input requirements and various options for application flexibility. GRA

N80-23256# Kaman Avidyne, Burlington, Mass.

THE VIBRA-8 SUBSONIC AERODYNAMIC NUCLEAR GUST VULNERABILITY CODE Final Report, Jul. 1978 - Feb. 1979

Garabed Zartarian 1 May 1979 23 p refs

(Contract DNA001-78-C-0317)

(AD-A081722; AD-E300674; KA-TR-164; DNA-4966F) Avail: NTIS HC A02/MF A01 CSCL 20/4

This report describes certain modifications to the subsonic aerodynamic subroutine in the earlier versions of VIBRA to extend the applicability of the nuclear vulnerability code over broader ranges of Mach number, aspect ratio, and sweep angles. This modified version, designated as VIBRA-8, was developed in conjunction with a study of the nuclear vulnerability of an aeronautical system. A separate classified report has been issued to cover that study. GRA

N80-23257# Avco Systems Div., Wilmington, Mass.

HYPERSONIC HEAT TRANSFER TEST PROGRAM IN THE VKI LONGSHOT FACILITY Final Report, 1 Dec. 1978 - 30 Nov. 1979

Victor Dicristina 18 Dec. 1979 26 p

(Contract F49620-79-C-0013; AF Proj. 2307)

(AD-A081467; AVSD-0335-79-CR; K500-79-VD-32; AFOSR-80-0124TR) Avail: NTIS HC A03/MF A01 CSCL 20/13

A summary of test results is presented for local pressure and heat transfer distributions on a biconic body for a range of hypersonic Mach numbers, Reynolds number, and angle-of-attack. The model configuration approximated nosetip contours typical of low altitude turbulent ablated shapes. Instrumentation included a longitudinal row of ten pressure taps and, 180 degrees apart, a row of eleven smooth calorimeter discs. The tests were performed in the Longshot Facility of the von Karman Institute for Fluid Dynamics. GRA

N80-23258# Boeing Military Airplane Development, Seattle, Wash.

EASY-ACIS DYNAMIC ANALYSIS. USER'S MANUAL Final Report, 15 Apr. 1977 - 1 Jun. 1979

M. K. Wahi, G. S. Duleba, and P. R. Perkins Wright-Patterson AFB, Ohio AFFDL Sep. 1979 291 p refs

(Contract F33615-77-C-3054; AF Proj. 2402)

(AD-A081160; AFFDL-TR-79-3106) Avail: NTIS HC A13/MF A01 CSCL 09/2

This report contains a summary description of the command language used in the EASY dynamic analysis program. In addition, a description of the inputs and outputs for each standard component in the ACLS library is given. GRA

N80-23259# Calspan Advanced Technology Center, Buffalo, N.Y. Aerodynamic Research Dept.

ANALYSIS OF EXPERIMENTS ON THE EFFECTS OF JET PLUMES ON PRESSURE DISTRIBUTION OVER A CYLINDRICAL AFTERBODY AT TRANSONIC SPEEDS Final Report

Joseph P. Nenni Feb. 1980 51 p refs

(Grant DAAG29-77-C-0008)

(AD-A081647; CALSPAN-AA-4017-W-16; ARO-13797.1-E) Avail: NTIS HC A04/MF A01 CSCL 21/8

The objective of the present investigation was to obtain experimentally, the effects of various jet plume parameters on afterbody pressure distributions and to partially validate the Korst modeling procedure. Analysis of the experimental results and supplemental calculations made by the method of characteristics show that the approximate theory used by Korst gives a good estimate of the plume shape for nozzle exit Mach number of 2.0 and below. For nozzle exit Mach numbers much in excess of 2.0, it appears desirable to include the effect of the nozzle wall boundary layer on plume shape. In addition, afterbody pressure distributions produced by a series of nozzles designed to produce the same plume shape, but with different values of the plume pliability parameter, have been compared with results from a solid plume simulator. In general, the solid plume simulator produces results that agree with the nozzles with the higher values of the plume pliability parameter at zero degrees angle of attack. The correlation deteriorates significantly, however, at five degrees angle of attack. Also, afterbody pressure distributions from model tests on the ZAP rocket motor are presented for future correlation with prototype results. GRA

N80-23260# McDonnell-Douglas Astronautics Co., St. Louis, Mo.

NUMERICAL FLOW FIELD PROGRAM FOR AERODYNAMIC HEATING ANALYSIS. VOLUME 2: USER'S MANUAL Final Technical Report, Jun. 1977 - Sep. 1979

H. J. Fivel Wright-Patterson AFB, Ohio AFFDL Dec. 1979 113 p refs Supersedes AFFDL-TR-79-3025 2 Vol.

(Contract F33615-77-C-3003; AF Proj. 2404)

(AD-A081472; AFFDL-TR-79-3128-Vol-2; AFFDL-TR-79-3025) Avail: NTIS HC A06/MF A01 CSCL 20/4

This report documents a study to modify an existing computer program which provides an economical and easy to use analytic tool for aerodynamic heating to a wide variety of 3 dimensional vehicle configurations. This report also serves as a user's manual for the computer program plus two auxiliary programs written to analyze vehicle geometry, and presents program capabilities, input/output characteristics, and example problems. Core requirements have been minimized by the use of overlays. User oriented features of the program include minimized input requirements and various options for application flexibility. GRA

N80-23261# Alabama Univ. in Huntsville. Dept. of Mechanical Engineering.

FINITE ELEMENT ANALYSIS OF SUBSONIC, TRANSONIC AND SUPERSONIC FLOWS AROUND MISSILES Final Report, 1976 - 1979

T. J. Chung Oct. 1979 73 p refs

(Grant DAAG29-76-G-0033)

(AD-A077375; UAH-RR-228; ARO-1913098.3-E) Avail: NTIS HC A04/MF A01 CSCL 20/4

This report examines the Galerkin finite element method for solving aerodynamics problems with emphasis on transonic flows. A shock element concept was proposed and computations were carried out. In this process, a quadratic isoparametric element is divided into quadrants with each quadrant having independent

trial functions. This idea allows discontinuities at the center of an element and shocks are allowed to develop freely. Rankin-Hugoniot conditions are satisfied accurately. Although this method is efficient until freestream Mach number reaches approximately 0.95, the solution seems to deteriorate significantly for M = 0.95. Toward the end of the reporting period, the author proposed a new approach - optimal control penalty finite elements. This method is suited ideally for problems of discontinuity and shock waves as a consequence of changes in the type of partial differential equations. The resulting equations are symmetric and positive-definite, their solution being type-independent. Numerous examples indicate that both stability and accuracy are maintained very satisfactorily for Tricomi and small perturbation equations. Detailed calculations applied to the full potential equations using this approach are beyond the scope of the present study. GRA

N80-23262# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
MORPHOLOGICAL-PHENOMENOLOGICAL EXAMINATION OF THE INTERACTION OF TWO RING VORTICES WITH THE SAME TRANSLATION AXIS AND DIRECTION [MORPHOLOGISCH - PHAENOMENOLOGISCHE UNTERSUCHUNG DER WECHSELWIRKUNG ZWEIER RINGWIRBEL GLEICHER TRANSLATIONSACHSE UND TRANSLATIONSRICHTUNG]
Peter E. M. Schneider Nov. 1978 110 p refs In GERMAN (MPIS-20/1978) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 25,65

With free jets and in the merging layer of two currents of different speeds, an interaction of succeeding ring and rectilinear vortices may be observed. This interaction may lead to a fusion of the proximate vortex systems. The morphological phenomena which have been observed when two ring vortices interact are described. Results are presented based upon observations as well as on the literature. Author (ESA)

N80-23263# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
OSCILLATIONS OF THE SUPERSONIC FLOW AT AN AREA OF ABRUPT INCREASE IN DUCT CROSS-SECTION [SCHWINGUNGEN DER UEBERSCHALLSTROEMUNG IN EINEM KANAL MIT QUERSCHNITTSSPRUNG]
A. P. Szumowski and G. E. A. Meier Dec. 1978 58 p refs In GERMAN
(MPIS-23/1978) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 13,50

The complex unsteady flow configurations occurring as a result of the interaction between shock waves and boundary layers is described, and experiments with flow in a duct performed. The mechanics of flow oscillations are considered, and stationary flow with perpendicular shock commented upon. Author (ESA)

N80-23264# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Antriebstechnik.
INVESTIGATION OF THREE-DIMENSIONAL SUBSONIC FLOW IN STRAIGHT CASCADES BY MEANS OF POTENTIAL FLOW CALCULATIONS AND EXPERIMENTS Ph.D. Thesis - Technische Univ.
Juergen Renken Oct. 1979 183 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-622)
(DFVLR-FB-79-09) Avail: NTIS HC A09/MF A01; DFVLR, Cologne DM 33,30

Two models for the calculation of incompressible potential flow are developed. One model calculates the influence of blade height and end wall shape on the velocity distribution in the cascade center section and requires only limited computer capacity. The second model, an extention of the first one, enables the calculation of the three dimensional aerodynamic blade end wall interaction. An outline of the problem of interaction between potential flow and secondary flow is presented. Author (ESA)

N80-23265# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Inst. fuer Theoretische Stroemungsmechanik.
LIFT, DRAG AND PITCHING MOMENT MEASUREMENTS ON A MISSILE BODY HAVING VARIOUS BOATTAILS AT SUBSONIC AND TRANSONIC VELOCITIES
Mauri Tanner Mar. 1979 86 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-628)
(DFVLR-FB-79-15) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 13,60

The lift, drag, and pitching moment of a missile body with boattailing were measured at Mach numbers from 0.5 to 1.0 at a Reynolds number of 340,000 in a transonic wind tunnel. Lift, drag, and longitudinal stability of the body was found to decrease when the relative base diameter decreased. Author (ESA)

N80-23266# Rolls-Royce Ltd., Derby (England).
UNSTEADY AERODYNAMIC FORCES ON A SUBSONIC RECTILINEAR CASCADE OF BLADES
H. Loiseau and J. Nicolas 1979 28 p refs Transl. into ENGLISH of conf. paper "Forces Aerodynamiques Instationnaires en Grille Rectiligne d'Aubes Subsonique" ONERA, Paris, Oct. 1976 In ENGLISH and FRENCH Presented at the RFM Symp., Paris, Oct. 1976 p 105-114
(PNR-90007; Trans-14737) Avail: NTIS HC A03/MF A01

Tests performed on Plenniger-Sulzer airfoils and NACA 65 A 006 airfoils, singly and in cascades in a subsonic wind tunnel to investigate aeroelastic phenomena in gas turbines are discussed. The simultaneous use of two measurement methods (forces extended from the variation in natural frequency and the damping of the rotating blade, and from pressures) is a certain means of checking the quality of the measurements. The choice of a vibrating configuration, where only one blade is subjected to an oscillating movement, is found to be particularly effective in minimizing the effects of the horizontal walls. Agreement between the theoretical and experimental results is comparable to that obtained from a wing or an aircraft model between the results of flutter calculations and flutter measurements in a wind tunnel. However, although phases coincide well, the test amplitude are approximately 20 percent lower overall than the theoretical amplitudes. Author (ESA)

N80-23267# European Space Agency, Paris (France).
PRESSURE DISTRIBUTION MEASUREMENTS ON WEDGES AT SUBSONIC AND TRANSONIC VELOCITIES
Mauri Tanner Nov. 1979 44 p refs Transl. into ENGLISH of "Druckverteilungsmessungen an Keilen bei Unterschall- und Transschallgeschwindigkeiten", Rept. DFVLR-FB-78-22 DFVLR, Cologne, Oct. 1978 Original report in GERMAN previously announced as N79-30156
(ESA-TT-554; DFVLR-FB-78-22) Avail: NTIS HC A03/MF A01; ZLDI, Munich 19,70

Measurements were performed in a wind tunnel on three wedges (apex angle of 8, 15, and 30 deg). Formulas are given for calculating pressure distributions and other characteristics associated with the wedge. Some comparisons are made with theoretically expected results. The pressure distribution on the wedge flank, the base pressure and the pressure drag vary considerably with Mach number and wedge angle. Author (ESA)

N80-23268# European Space Agency, Paris (France).
AFTERBODY DRAG AND BASE PRESSURE MEASUREMENTS ON A BODY OF REVOLUTION AT ANGLES OF INCIDENCE UP TO ALPHA = 25 DEG AT SUBSONIC AND TRANSONIC MACH NUMBERS
Mauri Tanner Nov. 1979 70 p refs Transl. into ENGLISH of "Heckwiderstands- und Basisdruckmessungen an einem fluckoerperrumpf bei Anstellwinkeln bis Alphas = 25 deg im Unterschallund Transschallbereicht", Rept. DFVLR-FB-78-14 DFVLR, Goettingen, West Germany, Jun. 1978 Original report in GERMAN previously announced as N79-30157
(ESA-TT-569; DFVLR-FB-78-14) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 26,90

Base pressure and afterbody drag measurements were performed in a wind tunnel. The Mach number had values from 0.5 to 1.0, the Reynolds number based on the model diameter was 340,000. Results show the influence of the boattail angle, the boattail length, and the relative base diameter on the base pressure and the afterbody drag at various angles of incidence. Author (ESA)

N80-23269# European Space Agency, Paris (France).
ON DISTURBANCE FIELDS OF MOVING SINGULARITIES IN AERODYNAMICS AND AEROACOUSTICS
Arabino Das Dec. 1979 90 p refs Transl. into ENGLISH of "Ueber Stoerfelder Bewegter Singularitaeten in der Aerodynamischen und Aeroakustik", Rept. DFVLR-FB-78-16 DFVLR, Brunswick, May 1978 Original report in GERMAN previously announced as N79-30158
(ESA-TT-570; DFVLR-FB-78-16) Avail: NTIS HC A05/MF A01; ZLDI, Munich DM 38,10

A unified method is presented in which arbitrary translatory motions of the disturbance sources, of the medium, and of the field point are admitted. The influence factors which arise from the kinematics of the disturbance field are derived and the physical processes involved are elucidated. The significance of the Lorentz transformation in problems of disturbance propagation from moving singularities is discussed. An evaluation of energy density and energy flux in disturbance fields is presented.
Author (ESA)

N80-23270# European Space Agency, Paris (France).
THE HARMONICALLY OSCILLATING BODY IN SUBSONIC FLOW: EFFECT OF COMPRESSIBILITY
Wolfgang Geissler Nov. 1979 42 p refs Transl. into ENGLISH of "Der Harmonisch Schwingende Rumpf in Unterschallstroemung: Einfluss der Kompressibilitaet", Rept. DFVLR-FB-78-24 DFVLR, Goettingen, West Germany, Nov. 1978 Original report in GERMAN previously announced as N79-30160
(ESA-TT-584; DFVLR-FB-78-24) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 20,20

The calculation of steady and unsteady airloads on harmonically oscillation bodies can be done by means of source and sink distributions on the real body surface. It is useful to do the calculation in a body fixed frame of reference. Pressures and forces on oscillating bodies were obtained for incompressible flow. The extension of this method to compressible subsonic flow is discussed. Numerical results are compared with other available methods for steady and unsteady flow about bodies.
Author (ESA)

N80-23271# European Space Agency, Paris (France).
FLUTTER STABILITIES IN AN ANNULAR CASCADE WITH SUPERSONIC RELATIVE FLOW
Pierre Salaun (ONERA, Paris, France) Feb. 1980 34 p refs Transl. into ENGLISH of "Instabilities de Flottement dans une Grille Annulaire en Ecoulement Relatif Supersonique", Rept. ONERA-P-1979-3 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-22277
(ESA-TT-610; ONERA-P-1979-3) Avail: NTIS HC A03/MF A01

A linearized three dimensional theory of the flow around a circular cascade of helical blades placed between two concentric cylinders is used; the relative flow is supersonic over the whole blade length, but the axial flow is subsonic. The influence of stagger angle, frequency, Mach number and number of blades on the stability of the first bending mode and the first torsion mode is studied. The first bending mode is always stable; the first torsion mode is usually unstable, but it is possible to suppress flutter by reducing the number of blades, at least in the example considered.
Author (ESA)

N80-23272# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Dept.
A WAKE BOUNDARY LAYER MIXING EXPERIMENT
P. J. Pot 2 Apr. 1979 8 p refs Presented at 2nd Symp. on Turbulent Shear Flows, London, 2-4 Jul. 1979
(NLR-MP-79012-U) Avail: NTIS HC A02/MF A01

The mixing of a boundary layer was investigated under zero pressure gradient with a two dimensional wake shed from a plate. Measurements of mean and fluctuating quantities were carried out for this flow in particular, as well as for one of the component flows, the isolated wake. Mean velocity, shear stress, turbulence intensities and mixing length development over a relatively large downstream region were surveyed for the mixed flow and comparisons were made with the corresponding isolated flows.
Author (ESA)

N80-23273# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.
SUMMARY OF DATA REQUIRED FOR THE AGARD SMP ACTIVITY STANDARD AEROELASTIC CONFIGURATIONS - TWO-DIMENSIONAL CONFIGURATIONS
R. J. Zwaan 30 Apr. 1979 26 p refs
(NLR-MP-79015-U) Avail: NTIS HC A03/MF A01

For the current AGARD structures and material panel (SMP) activity Standard Aeroelastic Configurations two airfoils were proposed for use in comparative calculations, one of which is the NLR 7301 airfoil. To facilitate reference to definitions of airfoil geometry and aerodynamic conditions and to experimental values, all relevant data are presented.
Author (ESA)

N80-23274# Bristol Univ. (England).
AN AEROELASTIC ANALYSIS OF THE SHERIFF WING B.S. Thesis
A. K. Fuan Jun. 1979 40 p refs
(BU-234) Avail: NTIS HC A03/MF A01

The aeroelastic behavior of the Sheriff wing, particularly the aileron dependent flutter characteristics was analyzed with the intention of minimizing the mass balance weight. Results are presented for wind divergence speed and control surface reversal. The mass and stiffness matrices and the associated eigenvalues and eigenvectors are discussed.
Author (ESA)

N80-23275# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN INVESTIGATION OF LOADS ON WEDGES PLACED IN SUPERSONIC JETS B.S. Thesis
B. Monk and K. Weatherill Jun. 1979 58 p refs
(BU-235) Avail: NTIS HC A04/MF A01

Load measurements and base pressure distributions were investigated for several wedges placed in an axisymmetric supersonic jet. The wedges, of base width equal to the nozzle exit diameter, were positioned symmetrically at various nozzle to wedge separations with the jet operated over a range of pressure ratios. The sensitivity of the overall loads to wedge floor separation was investigated. A set of measurements obtained for the overall loads and for the floor interference investigation is presented.
Author (ESA)

N80-23276# Bristol Univ. (England). Dept. of Aeronautical Engineering.
AN ASSESSMENT OF THE STABILITY AND OPENING CHARACTERISTICS OF CRUCIFORM PARACHUTES B.S. Thesis
M. D. Copcutt and P. L. Denner Jun. 1979 53 p ref
(BU-238) Avail: NTIS HC A04/MF A01

The stability of cruciform parachutes and the measurement of the forces which occurred during the inflationary phase were investigated. A number of cruciform parachutes, with arm ratios varying from 2 : 1 to 5 : 1, were constructed. Stability tests were performed by attaching the parachutes to a fixed point and observing their behavior in a wind tunnel. Force measurements were obtained by the horizontal deployment of the parachutes on a restraining cable. Cruciform parachutes were found to be more laterally stable than flat circular parachutes but they exhibit a spinning instability. Results indicate that the most promising arm ratios for parachute design are between two and a half to one and four to one.
Author (ESA)

N80-23277# Bristol Univ. (England). Dept. of Aeronautical Engineering.
WIND TUNNEL TESTS ON THE SHERIFF TWIN-ENGINED LIGHT AIRCRAFT B.S. Thesis
K. M. R. Walsh and S. Watkins Jun. 1979 76 p refs
(BU-241) Avail: NTIS HC A05/MF A01

The aerodynamics of the Sheriff twin-engined light aircraft were examined. Flow visualization experiments which gave evidence of a premature stall arising on the wing section between the nacelle and fuselage are described. A search for improvement was made using various high lift leading edge devices, fillets, and changes of nacelle geometry. Improved aerodynamic performance in the Sheriff by adopting pointed tail nacelles, leading edge cusps on the wing inboard of the nacelles, and fairings on the wing/fuselage junctions is discussed. Pressure readings taken

to assess the forces likely to be encountered on the canopy hatches are reported. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N80-23278# Crew Systems Consultants, Yellow Springs, Ohio.
CARBURETOR ICE: A REVIEW
Richard L. Newman 1980 97 p refs Backup document for AIAA Synoptic, 'Carburetor ice flight testing: The use of an anti-icing fuel additive', scheduled for publication in Journal of Aircraft in Oct. or Nov. 1980
Avail: NTIS HC A05/MF A01

Carburetor ice formation, a cause of engine failure and resultant aircraft accidents, is investigated. Prevention techniques include antiicing fuel additives, such as ethylene glycol monomethyl ether, deicing procedures, pilot education, and engine design. For individual titles, see N80-23279 through N80-23280.

N80-23279# Crew Systems Consultants, Yellow Springs, Ohio.
CARBURETOR ICE: A REVIEW
Richard L. Newman *In its* Carburetor Ice 1980 56 p refs (For primary document see N80-23278 14-03)
(TR-79-9) Avail: NTIS HC A05/MF A01

The effectiveness of 0.15 percent by volume of ethylene glycol monomethyl ether as an antiicing fuel additive was investigated in-flight using a PA-23 airplane equipped with O-320-A engines. Topics addressed include establishment of environmental conditions over which the carburetor is likely to form ice, rate of ice formation, and effectiveness of procedures for deicing a carburetor. The maximum amount of icing that can be safely tolerated was estimated. E.D.K.

N80-23280# Crew Systems Consultants, Yellow Springs, Ohio.
CARBURETOR ICE: A REVIEW
Richard L. Newman *In its* Carburetor Ice 1980 41 p refs (For primary document see N80-23278 14-03)
(TR-77-19) Avail: NTIS HC A05/MF A01

Records of aviation accidents due to carburetor icing are reviewed. Carburetor ice research, including formation and prevention techniques, is discussed. Possible solutions are presented with emphasis on fuel additives and a pilot education program. E.D.K.

N80-23281# Mitre Corp., McLean, Va.
OPPORTUNITIES ANALYSIS OF POTENTIAL ADVANCED VORTEX SYSTEMS SEPARATION STANDARDS
Dana L. Hall and Frank A. Amodeo Jul. 1979 73 p refs
(Contract DOT-FA79WA-4184)
(AD-A081479; MTR-79W00073; FAA-EM-79-17) Avail: NTIS HC A04/MF A01 CSCL 01/2

The benefits associated with conceptual Advanced Vortex Systems (AVS) are quantified from a delay reduction viewpoint. The findings are equally applicable to airborne vortex alleviation technology or to ground or air-based vortex avoidance systems. The delay consequences of three sets of successively closer interarrival standards are compared against the option of maintaining today's rules or a combination of today's and 3 nmi separations. The analysis was performed for only IFR weather conditions, since minimum required separation standards were selected as representative of possible AVS capabilities. Substantial delay savings are shown to be possible even with demand growth below that projected to occur across the 1985 through 1995 analysis time period. The benefits are sufficiently large as to warrant a substantial research and development investment into an AVS program. A.R.H.

N80-23282*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
STORM HAZARDS '79: F-106B OPERATIONS SUMMARY
Bruce D. Fisher, Gerald L. Keyser, Jr., Perry L. Deal, Mitchel E. Thomas, and Felix L. Pitts Mar. 1980 64 p refs
(NASA-TM-81779) Avail: NTIS HC A04/MF A01 CSCL 01C

Preliminary flight tests with a F-106B aircraft were made on the periphery of isolated thunder cells using weather radar support. In addition to storm hazards correlation research, a direct-strike lightning measurement experiment and an atmospheric chemistry experiment were conducted. Two flights were made to close proximity to lightning generating cumulonimbus clouds; however, no direct lightning strikes were experienced. Although no discernible lightning transients were recorded, many operational techniques were identified and established. R.E.S.

N80-23283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OUTLOOK FOR ADVANCED CONCEPTS IN TRANSPORT AIRCRAFT
D. William Conner Apr. 1980 21 p refs Presented at the 1980 Intern. Air Transportation Meeting, Cincinnati, 20-22 May 1980
(NASA-TM-81810; SAE-TP-800744) Avail: NTIS HC A02/MF A01 CSCL 01C

Air transportation demand trends, air transportation system goals, and air transportation system trends well into the 21st century were examined in detail. The outlook is for continued growth in both air passenger travel and air freight movements. The present system, with some improvements, is expected to continue to the turn of the century and to utilize technologically upgraded, derivative versions of today's aircraft, plus possibly some new aircraft for supersonic long haul, short haul, and high density commuter service. Severe constraints of the system, expected by early in the 21st century, should lead to innovations at the airport, away from the airport, and in the air. The innovations are illustrated by descriptions of three candidate systems involving advanced aircraft concepts. Advanced technologies and vehicles expected to impact the airport are illustrated by descriptions of laminar flow control aircraft, very large air freighters and cryogenically fueled transports. R.E.S.

N80-23284# National Aerospace Lab., Amsterdam (Netherlands). Structures Materials Dept.
FAILURE ANALYSIS IN AVIATION
E. A. B. deGraaf 14 Aug. 1978 48 p refs In DUTCH; ENGLISH summary
(NLR-MP-78028-U) Avail: NTIS HC A03/MF A01

The role of service failure analysis in defining new inspection procedures and the adoption of existing ones is illustrated. Examples include failures detected during inspections prescribed by the manufacturer, failures discovered after having learned of problems experienced by other operators of the same type of aircraft, and those found after an accident or by chance. Author (ESA)

N80-23285# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Dept.
THE FAILURE OF AIRCRAFT STRUCTURES
E. A. B. deGraaf 6 Dec. 1978 36 p refs In DUTCH; ENGLISH summary Presented at Bondsdag-Bond van Materialenkennis, Wageningen, Netherlands, 10 Nov. 1978
(NLR-MP-78040-U) Avail: NTIS HC A03/MF A01

A general discussion of aircraft structural failures and the design measures taken to prevent them are presented. Methods for determining static strength and stiffness, loads, and fatigue strength are surveyed. Modern design philosophies which take into account the possibility of initial defects, from which fatigue damage could originate are considered. Examples of structural failure are given and discussed. Author (ESA)

N80-23499*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER EMERGENCY CREW ESCAPE SYSTEM
William W. Lofland *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 33-46 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

N80-23511*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EMERGENCY IN-FLIGHT EGRESS OPENING FOR GENERAL AVIATION AIRCRAFT
Laurence J. Bement *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 173-194 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N80-23286# Logicon, Inc., San Pedro, Calif.
SOFTWARE IMPACT OF SELECTED EN ROUTE ATC COMPUTER REPLACEMENT STRATEGIES Final Report
W. D. Kandler, D. Weeton, and W. B. Cushing Dec. 1979 98 p refs
(Contract DOT-FA79WA-4313)
(AD-A081478; FAA-EM-79-15; Rept-7941-03) Avail: NTIS HC A05/MF A01 CSCL 17/7

The impacts and software constraints associated with transitioning to an en route air traffic control system are examined. The functional splitting of existing major system functions (flight data processing and radar data processing) and the implementation of system enhancements (en route minimum safe altitude warning and flight plan conflict probe) in a new computer system attached to the existing IBM 9020 system via a selector channel are described. The replacement of the IBM 9020 computer with an instruction-compatible computer system is also discussed. The required changes and predicted central processing unit and intersystem channel loading for each functional split are presented and implementation cost estimates provided. M.G.

N80-23287# Mitre Corp., McLean, Va. Metrek Div.
PROCEDURAL FEASIBILITY OF REDUCED SPACING UNDER WVAS OPERATION WITH APPLICATIONS TO ATLANTA AND O'HARE
Ronald G. Gados and Frank A. Amodeo Washington, D.C. FAA Aug. 1979 64 p refs
(Contract DOT-FA79WA-4184)
(AD-A081480; MTR-79W00243; FAA-EM-79-18) Avail: NTIS HC A04/MF A01 CSCL 01/2

A Wake Vortex Avoidance System (WVAS) may provide increased airport capacity by allowing for reduced aircraft separation standards on final approach under certain meteorological conditions. Three sets of reduced separation standards were hypothesized in order to describe the operational characteristics of potential WVAS systems. The analyses developed several operational schemes which allow aircraft to transition to reduced separation standards when under WVAS coverage, while maintaining larger terminal area standards prior to intercepting that coverage. Specific applications of these schemes to Atlanta Hartsfield and Chicago O'Hare International Airports are described. Procedures for and dynamics of transitioning between different sets of separation standards were investigated. Capacity benefits corresponding to the utilization of the different sets of separation standards under various operational procedures are estimated for Chicago and Atlanta. R.E.S.

N80-23288# National Aviation Facilities Experimental Center, Atlantic City, N. J.
A FLIGHT INVESTIGATION OF SYSTEM ACCURACIES AND OPERATIONAL CAPABILITIES OF A GENERAL AVIATION/AIR TRANSPORT AREA NAVIGATION SYSTEM (RNAV) Final Report, Nov. 1977 - Mar. 1979
Jack Edmonds, John Gallagher, and Robert Pursel Feb. 1980 104 p
(FAA Proj. 975-310-001)
(AD-A081646; FAA-NA-79-25) Avail: NTIS HC A06/MF A01 CSCL 17/7

Flight tests were conducted using a general aviation/air transport type area navigation system (RNAV) to investigation area navigation system accuracies and resultant airspace requirements. The system used very high frequency omnidirectional radio/distance measuring equipment (VOR/DME) radio data for position determination. Data and operational capabilities were also investigated, and graphical data are presented for parallel offsets, delay fans, and turn anticipation. Author

N80-23289# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEMS (GPS). MANPACK/VEHICULAR USER EQUIPMENT (MVUE), VOLUME 1 Final Report, Jun. 1975 - Aug. 1979
15 Aug. 1979 28 p
(Contract F04701-75-C-0181)
(AD-A076482; SAMSO-SD-TR-79-13-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 17/7

Texas Instrument's efforts to design and develop an alternate Manpack/Vehicular User Equipment (MVUE) set for use in the concept validation phase of GPS are described. Volume 1 summarizes design-to-cost goals and results; production engineering program, and field test reliability information. Maintainability analysis and fault isolation to achieve mean-time-to-repair goals are included. GRA

N80-23290# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEMS (GPS) HIGH DYNAMIC USER EQUIPMENT (HDUE). VOLUME 2: SET DESCRIPTION Final Report, Jun. 1975 - Aug. 1979
1 Aug. 1979 245 p 3 Vol.
(Contract F04701-75-C-0180)
(AD-A076480; SAMSO-SD-TR-79-12-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 17/7

Describes Texas Instruments design of the HDUE set as implemented during phase 1 of the GPS program, including system description; HDUE receiver control, Master Control, Navigation and Executive Subsystems; and Hardware System Description. GRA

N80-23291# Texas Instruments, Inc., Dallas. Equipment Group.
GLOBAL POSITIONING SYSTEM (GPS) HIGH DYNAMIC USER EQUIPMENT (HDUE). VOLUME 3: SET DESCRIPTION Final Report, Jun. 1975 - Aug. 1979
1 Aug. 1979 373 p
(Contract F04701-75-C-0180)
(AD-A076481; SAMSO-SD-TR-79-12-Vol-3) Avail: NTIS HC A16/MF A01 CSCL 17/7

This volume contains descriptions of both software/hardware modules in the HDUE system, which includes receiver software, master state control, navigation software, executive software, receiver LRU and navigation LRU descriptions. GRA

N80-23292# Mission Research Corp., Santa Barbara, Calif.
PREDICTIONS OF GPS X-SET PERFORMANCE DURING THE PLACES EXPERIMENT Progress Report, Jul. 1978 - Jun. 1979
D. L. Kneepp and R. L. Bogusch 1 Jul. 1979 123 p refs
(Contract DNA001-78-C-0364; DNA Proj. NWET-I25AAXHX642)
(AD-A081552; AD-E300664; MRC-R-514; DNA-5038T) Avail: NTIS HC A06/MF A01 CSCL 18/3

Preexperimental predictions of GPS X-set receiver performance during the PLACES barium release experiment are presented for carrier frequencies from 150 to 250 MHz. Detailed examples of the X-set phase, frequency and code tracking performance are shown. For mean carrier power-to-noise density ratios of 35 db-Hz and less, erroneous Doppler aiding from the AFC/Costas loop can cause degradations to the otherwise adequate code tracking loop. All receiver performance results presented are obtained using numerical multiple phase screen calculations of frequency-selective signal propagation through simulated barium clouds. These calculations are based upon a statistical model of a striated barium cloud developed from Fourier

analysis of back propagation data taken during the STRESS barium release series. This model includes representation of the important barium striation parameters derived from measured power spectral density (PSD) properties including phase standard deviation, spectral index, and outer scale. GRA

N80-23293# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
IMPROVED PACKAGING FOR THE LN-31 INERTIAL MEASUREMENT UNIT (F-15 AIRCRAFT)
Frank C. Jarvis Mar. 1980 14 p
(AD-A081745; PTPT-80-2) Avail: NTIS HC A02/MF A01 CSCL 17/7

The investigation of the current packaging for the F-15 Inertial Measurement Unit (LN-31 IMU) revealed that the pack will provide adequate shock and vibration protection for the item; however, it was anticipated that a less expensive pack could be developed at a cost savings of approximately 25% (PTPT Report 79-3, Packaging and Handling Analysis of the LN-31, 683420-14, Inertial Measurement Unit). A new improved pack was developed and evaluated. The estimated cost savings is 20% and the potential implementation date is scheduled for June 1980. GRA

N80-23294# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE IMPACT OF GLOBAL POSITIONING SYSTEM ON GUIDANCE AND CONTROLS SYSTEMS DESIGN OF MILITARY AIRCRAFT. VOLUME 2D: SPECIFIC STUDY NO. 4, GYRO ACCURACY REQUIREMENTS IN A STRAP DOWN INERTIAL NAVIGATION SYSTEM WITH GPS AIDING FOR RPV MISSIONS
K. Hurrass, ed. (Inst. fuer Flugfuehrung, Flughafen, Germany) and H. Winter, ed. (Inst. fuer Flugfuehrung, Flughafen, Germany) Feb. 1980 15 p
(AGARD-AR-147-Vol-2D) Avail: NTIS HC A02/MF A01

The influence of the NAVSTAR Global Positioning System aiding of a strap-down system on the accuracy requirements for the gyros was investigated for a remotely piloted vehicle. R.E.S.

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-23295* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OPERATIONS MANUAL: VERTICAL MOTION SIMULATOR (VMS) S.08
A. David Jones May 1980 70 p
(NASA-TM-81180; A-8095) Avail: Issuing Activity CSCL 14B

The Ames Research Center Vertical Motion Simulator (VMS) is described in terms useful to the researcher who intends to use it. A description of the VMS and its performance are presented together with the administrative policies governing its operation. The management controls over its use are detailed, including data requirements, user responsibilities, and scheduling procedures. This information is given in a form that should facilitate communication with the NASA operations group during initial simulator use. J.M.S.

N80-23296 Stanford Univ., Calif.
ESTIMATION OF WIND SHEAR AND THRUST LOSS DURING STOL AIRCRAFT LANDING APPROACH Ph.D. Thesis
Joseph Andrew Bossi 1980 125 p
Avail: Univ. Microfilms Order No. 8011611

Techniques for designing constant gain estimators when uncertainties are present in the dynamic model were investigated. Modification of the steady state Kalman filter are described which provides a satisfactory estimator in such cases. Also, methods for predicting the performance sensitivity of estimator designs are described. The results of applying these techniques to the design of an estimator for wind shear and thrust loss on a STOL aircraft are presented. Estimator performance was verified using a digital flight simulation of the aircraft on final approach. Dissert. Abstr.

N80-23297 Princeton Univ., N. J.
AN ANALYTICAL STUDY OF TILT PROPROTOR AIRCRAFT DYNAMICS IN AIRPLANE CRUISE CONFIGURATION INCLUDING THE EFFECTS OF FUSELAGE LONGITUDINAL RIGID BODY MOTION Ph.D. Thesis
Tatsuo Komatsuzaki 1980 430 p
Avail: Univ. Microfilms Order No. 8011032

The dynamics of tilt proprotor aircraft in symmetric motion in airplane cruise configuration were examined with the effects of the fuselage longitudinal rigid body motion included. The reference values of the physical parameters were mainly based on those of the Bell XV-15, a tilt rotor research aircraft. The influence of the fuselage motion on the aeroelastic stability of the proprotor/wing system was investigated, as well as the influence of the proprotor/wing system dynamics on the stability and control characteristics of the vehicle. In addition, the effects of various feedbacks were examined with particular emphasis placed upon the feasibility of using relatively simple feedbacks to improve the dynamic stability characteristics of the proprotor/wing system. Prior to investigating the dynamics of the complete system, the dynamics of simplified models with reduced number of motion degrees of freedom was examined in some detail in order to obtain physical insights into the dynamics of the more complex system. Dissert. Abstr.

N80-23298# Decisions and Designs, Inc., McLean, Va.
DECISION ANALYSIS OF ADVANCED SCOUT HELICOPTER CANDIDATES Final Technical Report
Michael L. Donnell and Jacob W. Ulvila Jan. 1980 98 p refs
(Contract DAAK50-79-C-0035)
(AD-A081483; PR-80-1-307) Avail: NTIS HC A05/MF A01 CSCL 01/3

An analysis is described for thirteen Advanced Scout Helicopter (ASH) candidates and mixtures of those candidates. The analysis evaluates the candidates on the basis of their military worth; life cycle costs; attainability; force structure personnel impact; and rationalization, standardization and interoperability impact. The major portion of the report describes and explains the methodology used to evaluate the candidates, presents the results of the analysis, and illustrates several of the sensitivity analyses that were performed. Detailed assessments used in the analysis are reported in the appendices. GRA

N80-23299# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
INVESTIGATION OF LANDING FLARE IN PRESENCE OF WIND SHEAR
Knut Wilhelm and Martin Marchand Jun. 1979 55 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-631)
(DFVLR-FB-79-20) Avail: NTIS HC A04/MF A01; DFVLR, Cologne DM 11.50

The effects of wind shear on the arrested landing of conventional and short take off aircraft were calculated. The aircraft trajectory during the landing maneuver is given in analytical form as a function of wind speed and pilot aircraft controls. Various examples are used to illustrate the effect, resulting in specific recommendations for pilot control during the aircraft landing. Author (ESA)

N80-23300# European Space Agency, Paris (France).
INVESTIGATIONS OF THE DESIGN OF ACTIVE VIBRATION ISOLATION SYSTEMS FOR HELICOPTERS WITH RIGID AND ELASTIC MODELING OF THE FUSELAGE
Gerd Schulz Nov. 1979 66 p refs Transl. into ENGLISH of "Untersuchungen zur Auslegung von Vollaktiven Schwingungsisolationssystemen fuer Hubschrauber bei Starrer und Elastischer Zellenmodellierung", Rept. DFVLR-FB-78-04 DFVLR, Oberpfaffenhofen, West Germany Original report in GERMAN previously announced as N79-30183
(ESA-TT-556; DFVLR-FB-78-04) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 25.70

Different methods for the design of controllers for active vibration isolation on helicopters are investigated. Based on the special structure of the controller, compensation for the rotor blade harmonic disturbance vibrations is achieved, guaranteeing good trim behavior during maneuvers. For the first controller design, done for a rigid helicopter fuselage with a modified Riccati design, different sensor configurations are investigated. A possibility for sensitivity reduction for rotor speed variations is shown. For the second controller design for an elastic helicopter fuselage the modified Riccati design, the design by means of Nyquist plots and pole assignment are investigated, especially with respect to the applicability for higher order systems.
Author (ESA)

N80-23301# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FLIGHT SAFETY OF ROGALLO HANG GLIDERS. THEORETICAL AND EXPERIMENTAL STUDY OF THE FLIGHT ENVELOPE
Claudius LaBurthe and Simone Walden 1979 227 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-634)
(ONERA-NT-1979-8) Avail: NTIS HC A11/MF A01

Two series of full scale wind tunnel tests were completed on 15 hang gliders. The results were used to calculate the basic performance and stability characteristics and to analyze the critical limitations. The problem of pitching stability is highlighted in the analysis. Implications of the results in areas such as take off, stall, dives, and settings are discussed. Author (ESA)

N80-23302# Bristol Univ. (England). Dept. of Aeronautical Engineering.
INVESTIGATION OF A FOAM SUPPORTED GLASS FIBER D-BOX FOR A RIGID WING HANG GLIDER B.S. Thesis
N. A. Ruddick Jun. 1979 22 p refs
(BU-240) Avail: NTIS HC A02/MF A01

A proposed design for a foam supported, glass fiber covered D-box for use as a wing primary structure in a rigid wing hang glider is investigated. An arrangement for bracing the wing was analyzed and the performance of the structure in bending was verified. The stability of the D-box walls in torsion was investigated. Author (ESA)

N80-23303# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).
THE IMPACT OF GLOBAL POSITIONING SYSTEM ON GUIDANCE AND CONTROLS SYSTEMS DESIGN OF MILITARY AIRCRAFT. VOLUME 2A: SPECIFIC APPLICATION STUDY NO. 1, CLOSE AIR SUPPORT
Louis J. Urban, ed. (ASD) Feb. 1980 70 p
(AGARD-AR-147-Vol-2A; ISBN-92-835-1349-5) Avail: NTIS HC A04/MF A01

The application of NAVSTAR/Global Positioning System to Close Air Support is described. A currently available 'model' was selected, namely the F-4E aircraft equipped with the ARN-101 weapon delivery system. This was selected since it represents the current state-of-the-art for externally aided (LORAN) digital avionics system integrated into a reasonably modern fighter aircraft which is currently in the operational inventory of several NATO countries. R.E.S.

N80-23514*# Boeing Commercial Airplane Co., Seattle, Wash.
AIRPLANE WING LEADING EDGE VARIABLE CAMBER FLAP
James B. Cole *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 225-235 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N80-23304*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
WIND TUNNEL INVESTIGATION OF AN ALL FLUSH ORIFICE AIR DATA SYSTEM FOR A LARGE SUBSONIC AIRCRAFT
Terry J. Larson, Stuart G. Flechner, and Paul M. Siemers, III May 1980 97 p refs
(NASA-TP-1642; H-1085) Avail: NTIS HC A05/MF A01 CSCL 01D

The results of a wind tunnel investigation on an all flush orifice air data system for use on a KC-135A aircraft are presented. The investigation was performed to determine the applicability of fixed all flush orifice air data systems that use only aircraft surfaces for orifices on the nose of the model (in a configuration similar to that of the shuttle entry air data system) provided the measurements required for the determination of stagnation pressure, angle of attack, and angle of sideslip. For the measurement of static pressure, additional flush orifices in positions on the sides of the fuselage corresponding to those in a standard pitot-static system were required. An acceptable but less accurate system, consisting of orifices only on the nose of the model, is defined and discussed. R.E.S.

N80-23305# Douglas Aircraft Co., Inc., Long Beach, Calif.
FLIGHT TEST EVALUATION OF AIRBORNE TIRE PRESSURE INDICATING SYSTEMS Final Report, Oct. 1978 - Aug. 1979
Ronald L. Suiter and Wilson W. Kwong Sep. 1979 114 p
(Contract DOT-FA77WA-4070)
(AD-A081598; FAA-RD-78-134-2) Avail: NTIS HC A06/MF A01

Six different cockpit tire pressure indicating systems were flight tested on two DC-10 aircraft; a seventh was tested on a DC-9. The systems evaluated include three analog tire pressure system concepts displaying actual tire pressure in the cockpit, two weight and balance systems measuring tire pressure indirectly via tire load and axle tilt, a go-no-go discrete pressure sensing system, and a wheel speed system that uses change in rolling radius to detect a low tire. A test evaluation for each of the systems and comments on the general merits of each system type are included. A recommendation is made that each system be subjected to airline service tests before entering fleet service. A.R.H.

N80-23306# McDonnell-Douglas Electronics Co., St. Charles, Mo.
VISUALLY COUPLED SYSTEM: COMPUTER GENERATED IMAGERY (VCS-CGI) ENGINEERING INTERFACE Final Report, Aug. 1977 - Mar. 1979
Shelton MacLeod and David B. Coblitz Wright-Patterson AFB, Ohio AMRL Nov. 1979 71 p refs
(Contract F33615-77-C-0524; AF Proj. 7184)
(AD-A080931; AMRL-TR-79-32) Avail: NTIS HC A04/MF A01 CSCL 14/2

The Visually-Coupled System Computer-Generated Imagery (VCS-CGI) Interface program had two main phases. The objective for the first phase was to successfully interface the various subcomponents (helmet-mounted sight, helmet-mounted displays, and advanced computer-generated image system) and demonstrate their compatibility and feasibility for use in wide field of view, air-to-ground visual simulation. The objective for the second phase was to conduct a systematic exploration and evaluation of various system parameters that could affect display quality. GRA

N80-23307# Sandia Labs., Albuquerque, N. Mex. Exploratory Systems Div.
STUDY OF HIGH-ALTITUDE RADAR ALTIMETER MODEL ACCURACY AND SITAN PERFORMANCE USING HAAFT DATA
Thomas C. Shieves and Michael W. Callahan Jul. 1979 161 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1380) Avail: NTIS HC A08/MF A01

Radar altimetry data, inertial navigation data, and scoring data are used in conjunction with topographic data to evaluate the accuracy of a high-altitude pulsed-radar altimeter model and

the resulting performance of an inertial terrain-aided guidance concept. The high-altitude flight test data analyzed show a system CEP of 120 m. The radar altimeter model that was required to achieve this performance includes the effects of the internal track loop, automatic gain control loop, antenna beamwidth, and the terrain radar cross section and provided a factor of six improvement over simple nadir ground clearance for rough terrain. It is postulated that high-altitude CEP could be reduced to 50 m or less if an altimeter were designed specifically for high-altitude terrain sensing. DOE

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-23308 Pennsylvania State Univ., University Park.
AXIAL FLOW ROTOR UNSTEADY PERFORMANCE Ph.D. Thesis
Edgar Perrin Bruce 1979 250 p
Avail: Univ. Microfilms Order No. 8010028

An existing two dimensional, nonviscous theory which employed a simplified vortex model in conjunction with the assumptions of thin airfoil theory to define cascade unsteady lift was modified and extended to include an expression for unsteady pitching moment. Computed theoretical results were compared with measured values of unsteady lift force and pitching moment coefficients and their phase angles and with the unsteady center-of-pressure position. In a large axial flow fan test facility, specially designed screens were employed to produce a variety of rotor inlet flows having a sinusoidally varying axial velocity component. Uncambered rotor response during operation in these harmonically varying inflows was determined by employing a strain-gaged sensing element on one rotor blade. The results show that, in general, the theory tends to overpredict the magnitude of the force and moment coefficients, that good agreement exists between the majority of the measured and predicted phase angle data, and that the validity of the theory in its present form should be restricted to values of reduced frequency greater than 0.8. Dissert. Abstr.

N80-23309*# General Electric Co., Cincinnati, Ohio.
CF6 JET ENGINE PERFORMANCE IMPROVEMENT: NEW FAN
W. A. Fasching May 1980 202 p
(Contract NAS3-20629)
(NASA-CR-159699; R79AEG413) Avail: NTIS HC A10/MF A01 CSCL 21E

As part of the NASA sponsored engine component improvement program, and fan package was developed to reduce fuel consumption in current CF6 turbofan aircraft engine. The new fan package consist of an improved fan blade, reduced fan tip clearance due to a fan case stiffener, and a smooth fan casing tip shroud. CF6 engine performance and acoustic tests demonstrated the predicted 1.8% improvement in cruise sfc without an increase in engine noise. Power management thrust/fan speed characteristics were defined. Mechanical and structural integrity was demonstrated in model fan rotor photoelastic stress tests, full-size fan blade bench fatigue tests, and CF6 engine bird ingestion, crosswind, and cyclic endurance tests. The fan was certified in the CF6-500c2/E2 engines and is in commerical service on the Boeing 747-200, Douglas DC-10-30, and Atrbus industrie A300B aircraft. A.R.H.

N80-23310*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIGNIFICANCE OF THERMAL CONTACT RESISTANCE IN TWO-LAYER THERMAL-BARRIER-COATED TURBINE VANES
Curt H. Liebert and Raymond E. Gaugler 1980 11 p refs Presented at the Intern Conf. on Met. Coatings, San Diego, Calif., 21-25 Apr. 1980; sponsored by the Am. Vacuum Soc. (NASA-TM-81483; E-420) Avail: NTIS HC A02/MF A01 CSCL 21E

The importance of thermal contact resistance between layers in heat transfer through two layer, plasma sprayed, thermal barrier coatings applied to turbine vanes was investigated. Results obtained with a system of NiCrAlY bond and yttria stabilized zirconia ceramic show that thermal contact resistance between layers is negligible. These results also verfied other studies which showed that thermal contact resistance is negligible for a different coating system of NiCr bond calcia stabilized zirconia ceramic. The zirconia stabilized ceramic thermal conductivity data scatter presented in the literature is ±20 to -10 percent about a curve fit of the data. More accurate predictions of heat transfer and metal wall temperatures are obtained when the thermal conductivity values are used at the ±20 percent level. E.D.K.

N80-23311*# Hamilton Standard, Windsor Locks, Conn.
ACOUSTIC TEST AND ANALYSES OF THREE ADVANCED TURBOPROP MODELS Final Report
Bennett M. Brooks and F. B. Metzger Jan. 1980 245 p refs
(Contract NAS3-20614)
(NASA-CR-159667) Avail: NTIS HC A11/MF A01 CSCL 21E

Results of acoustic tests of these 62.2 cm (24.5 inch) diameter models of the prop-fan (a small diameter, highly loaded, Multi-bladed variable pitch advanced turboprop) are presented. Results show that there is little difference in the noise produced by unswept and slightly swept designs. However, the model designed for noise reduction produces substantially less noise at test conditions simulating 0.8 Mach number cruise speed or at conditions simulating takeoff and landing. In the near field at cruise conditions the acoustically designed, In the far field at takeoff and landing conditions the acoustically designed model is 5 db quieter than unswept or slightly swept designs. Correlation between noise measurement and theoretical predictions as well as comparisons between measured and predicted acoustic pressure pulses generated by the prop-fan blades are discussed. The general characteristics of the pulses are predicted. Shadowgraph measurements were obtained which showed the location of bow and trailing waves. R.C.T.

N80-23312*# Pratt and Whitney Aircraft Group, East Hartford, Conn.
CORE COMPRESSOR EXIT STAGE STUDY, 2 Final Report
R. F. Behlke, E. A. Burdsall, E. Canal, Jr., and N. D. Korn Oct. 1979 90 p refs
(Contract NAS3-20578)
(NASA-CR-159812; PWA-5561-66) Avail: NTIS HC A05/MF A01 CSCL 21E

A total of two three-stage compressors were designed and tested to determine the effects of aspect ratio on compressor performance. The first compressor was designed with an aspect ratio of 0.81; the other, with an aspect ratio of 1.22. Both compressors had a hub-tip ratio of 0.915, representative of the rear stages of a core compressor, and both were designed to achieve a 15.0% surge margin at design pressure ratios of 1.357 and 1.324, respectively, at a mean wheel speed of 167 m/sec. At design speed the 0.81 aspect ratio compressor achieved a pressure ratio of 1.346 at a corrected flow of 4.28 kg/sec and an adiabatic efficiency of 86.1%. The 1.22 aspect ratio design achieved a pressure ratio of 1.314 at 4.35 kg/sec flow and 87.0% adiabatic efficiency. Surge margin to peak efficiency was 24.0% with the lower aspect ratio blading, compared with 12.4% with the higher aspect ratio blading. R.C.T.

N80-23313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEVELOPMENT OF IMPROVED-DURABILITY PLASMA SPRAYED CERAMIC COATINGS FOR GAS TURBINE ENGINES
Irving E. Sumner and Duane L. Ruckle (Pratt and Whitney Aircraft, East Hartford, Conn.) 1980 25 p refs Proposed for presentation at the 16th Joint Propulsion Conf., Hartford, 30 Jun. - 2 Jul. 1980; sponsored by AIAA, ASME and SAE
(NASA-TM-81512; E-451) Avail: NTIS HC A02/MF A01 CSCL 21E

As part of a NASA program to reduce fuel consumption of current commercial aircraft engines, methods were investigated for improving the durability of plasma sprayed ceramic coatings for use on vane platforms in the JT9D turbofan engine. Increased durability concepts under evaluation include use of improved strain tolerant microstructures and control of the substrate temperature during coating application. Initial burner rig tests conducted at temperatures of 1010 C (1850 F) indicate that improvements in cyclic life greater than 20:1 over previous ceramic coating systems were achieved. Three plasma sprayed coating systems applied to first stage vane platforms in the high pressure turbine were subjected to a 100-cycle JT9D engine endurance test with only minor damage occurring to the coatings. A.R.H.

N80-23314*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OSCEE FAN EXHAUST BULK ABSORBER TREATMENT EVALUATION

H. E. Bloomer and Nick E. Samanich 1980 20 p refs Presented at 6th Aeroacoustics Conf., 4-6 June 1980; sponsored by AIAA

(NASA-TM-81498; E-435) Avail: NTIS HC A02/MF A01 CSCL 21E

The acoustic suppression capability of bulk absorber material designed for use in the fan exhaust duct walls of the quiet clean short haul experiment engine (OCSEE UTW) was evaluated. The acoustic suppression to the original design for the engine fan duct which consisted of phased single degree-of-freedom wall treatment was tested with a splitter and also with the splitter removed. Peak suppression was about as predicted with the bulk absorber configuration, however, the broadband characteristics were not attained. Post test inspection revealed surface oil contamination on the bulk material which could have caused the loss in bandwidth suppression. R.C.T.

N80-23315*# Williams Research Corp., Walled Lake, Mich.

CONCEPTUAL DESIGN STUDY OF AN IMPROVED GAS TURBINE POWERTRAIN Final Report

W. I. Chapman Mar. 1980 294 p refs

(Contracts DEN3-12; EC-77-A-31-1040)

(NASA-CR-159852; DOE/NASA/0013-80/1; WRC-78-182) Avail: NTIS HC A13/MF A01 CSCL 21E

The conceptual design for an improved gas turbine (IGT) powertrain and vehicle was investigated. Cycle parameters, rotor systems, and component technology were reviewed and a dual rotor gas turbine concept was selected and optimized for best vehicle fuel economy. The engine had a two stage centrifugal compressor with a design pressure ratio of 5.28, two axial turbine stages with advanced high temperature alloy integral wheels, variable power turbine nozzle for turbine temperature and output torque control, catalytic combustor, and annular ceramic recuperator. The engine was rated at 54.81 kW, using water injection on hot days to maintain vehicle acceleration. The estimated vehicle fuel economy was 11.9 km/l in the combined driving cycle, 43 percent over the 1976 compact automobile. The estimated IGT production vehicle selling price was 10 percent over the comparable piston engine vehicle, but the improved fuel economy and reduced maintenance and repair resulted in a 9 percent reduction in life cycle cost. R.C.T.

N80-23316*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

CF6-6D ENGINE SHORT-TERM PERFORMANCE DETERIORATION

W. H. Kramer, J. E. Paas, J. J. Smith, and R. H. Wulf Apr. 1980 154 p

(Contract NAS3-20631)

(NASA-CR-159830; R80AEG374) Avail: NTIS HC A08/MF A01

Studies conducted as part of the NASA-Lewis CF6 jet engine diagnostics program are summarized. An 82-engine sample of DC-10-10 aircraft engine checkout data that were gathered to define the extent and magnitude of CF6-6D short term performance deterioration were analyzed. These data are substantiated by the performance testing and analytical teardown of CF6-6D short term deterioration engine serial number (ESN) 451507. R.C.T.

N80-23317*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

STATIC CALIBRATION OF A TWO-DIMENSIONAL WEDGE NOZZLE WITH THRUST VECTORING AND SPANWISE BLOWING

Michael J. Harris (Naval Ship Research and Development Center, Bethesda, Md.) and Michael D. Falarski Apr. 1980 38 p refs (NASA-TM-81161; A-8043) Avail: NTIS HC A03/MF A01 CSCL 21E

The results of a static calibration of the two dimensional wedge nozzles on a STOL configuration of a large-scale fighter model are reported. These nozzles internally turn the efflux produced by two turbojets down 25 degrees and exhaust it over the deflected trailing edge of the wing. This arrangement provides direct thrust lift, enhances wing lift by producting supercirculation, and provides thrust vectoring by varying the deflection of the wing's trailing edge. The thrust is vectored from 10 deg to 38 deg. This system was calibrated with spanwise blowing for augmentation of the leading-edge vortex. When 16% of the turbojet efflux is blown spanwise, the thrust recovered is 92% of the thrust produced when the total efflux is exhausted longitudinally. E.D.K.

N80-23318# Pennsylvania State Univ., University Park. Applied Research Lab.

AXIAL FLOW ROTOR UNSTEADY PERFORMANCE

E. P. Bruce 14 Aug. 1979 256 p refs

(Contract N00024-79-C-6043)

(AD-A081107; ARL/PSU-TM-79-149) Avail: NTIS HC A12/MF A01 CSCL 20/4

Two problems facing designers of axial flow turbomachines at present are requirements for operation with increased efficiency and reduced radiated noise. To meet these requirements, it is necessary to have detailed information on the influence of geometrical and operating characteristics of blade rows on their unsteady response to distortions in the inflow velocity field. Unsteady response as defined here refers to the unsteady lift force and pitching moment generated on a rigid (i.e., nonvibrating) blade operating in a nonuniform, inviscid, incompressible flow. The unsteady pressure upon which the unsteady force and moment depends is also responsible for generation of part of the radiated acoustic or noise field. In this study, the objective was to investigate unsteady response. Thus, the acoustic problem was not treated in detail. However, a brief discussion is presented which shows how the results can be applied to define the related acoustic source field. In this study, an existing two dimensional, nonviscous theory which employed a simplified vortex model in conjunction with the assumptions of thin airfoil theory to define cascade unsteady lift was modified and extended to include an expression for unsteady pitching moment. Computed theoretical results were compared with measured values of unsteady lift force and pitching moment coefficients and their phase angles and with the unsteady center-of-pressure position. GRA

N80-23319# Naval Postgraduate School, Monterey, Calif.

A PRIMITIVE VARIABLE COMPUTER MODEL FOR COMBUSTION WITHIN SOLID FUEL RAMJETS Final Report

Charles A. Stevenson and David W. Netzer Oct. 1979 45 p refs Prepared for Naval Weapons Center, China Lake, Calif.

(AD-A081081; NPS67-79-010) Avail: NTIS HC A03/MF A01 CSCL 21/5

An adaptation of a primitive variable, finite-difference computer program was accomplished in order to predict the reacting flow field in a solid fuel ramjet. The study compares the predictions of the primitive variable computer model with an earlier computer model and empirical data. It was found that the new model reasonably predicted the flow field and permitted calculations within the aft mixing chamber. GRA

N80-23320# Solar Turbines International, San Diego, Calif.

APPLICATION OF CERAMIC NOZZLES TO 10 KW ENGINE Final Report

James C. Napier and A. G. Metcalfe Dec. 1978 263 p refs

(Contract DAAK02-75-C-0138)
(AD-A081184; SRB0-R-4375-43; SO-6-4375-7) Avail: NTIS HC A12/MF A01 CSCL 21/5

Work on application of ceramics to the nozzle section of the small radial MERADCOM 10 KW gas turbine engine for meeting the two separate goals of improved erosion resistance and increased turbine inlet temperature is reported. Engine demonstrations of each of the two ceramic nozzle designs were completed. Efforts leading to engine demonstrations are documented and included; ceramic materials properties studies; design studies; engine simulator experiments for high temperature erosion, corrosion and thermal shock; and development of specialized relaxing glass adhesives for joining of ceramics. It was demonstrated that ceramics can offer from 10 to 100 times the erosion resistance at 1700 F to superalloys and have excellent corrosion and thermal shock properties. GRA

N80-23321# Naval Postgraduate School, Monterey, Calif.
ATMOSPHERIC DISPERSION OF HIGH VELOCITY JETS Final Report
Jack V. Brendmoen and David W. Netzer Nov. 1979 84 p refs
(ZF57572002)
(AD-A081612; NPS67-76-012) Avail: NTIS HC A05/MF A01 CSCL 21/5

A neutrally stable atmospheric surface layer was simulated in a low speed wind tunnel by tripping the boundary layer with a fence and letting the turbulent flow develop over a length of roughness elements. Turbojet exhaust dispersion characteristics, simulated by a burner/nozzle system, were investigated by measuring the horizontal and vertical temperature profiles at axial stations downwind from the nozzle exit. Dispersion sensitivity to different nozzle exit conditions, angles of incidence to the wind, and nozzle surface blockage were investigated. The results were compared to dispersion methods used in the Air Quality Assessment Model (AQAM). It was found that (1) the experimental jet penetration length was much shorter than that assumed in AQAM; (2) the horizontal jet exhibited plume rise; (3) the initial dispersion coefficients were a function of wind direction; and (4) the plume spreading rate was more rapid than for the low velocity, elevated sources in neutrally stable atmospheric conditions. GRA

N80-23322# IIT Research Inst., Chicago, Ill.
PROPERTY SCREENING AND EVALUATION OF CERAMIC TURBINE ENGINE MATERIALS Final Report, 1 Jul. 1975 - 1 Aug. 1979
D. C. Larsen Wright-Patterson AFB, Ohio AFML Oct. 1979 152 p refs
(Contract F33615-75-C-519616)
(AD-A080963; AFML-TR-79-4188) Avail: NTIS HC A08/MF A01 CSCL 11/2

An overview is presented of the pertinent thermal and mechanical properties of 26 structural silicon-base non-oxide ceramics that are candidates for advanced heat engine applications. Included are hot pressed, sintered and reaction sintered Si3N4 and SiC, and Sialon. Data are presented for flexure strength, elastic properties, strength degradation at long times due to subcritical crack growth, long term oxidation effects, creep resistance, fracture toughness, thermal expansion, thermal diffusivity, and thermal shock resistance. All materials are evaluated using the same test equipment so that valid comparisons can be made between materials. Emphasis is placed on predominant behavioral trends as related to material microstructure and purity, as determined by processing method. Structure-property relations are developed. GRA

N80-23323# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Turbine Engine Div.
TURBOPROPULSION COMBUSTION TECHNOLOGY ASSESSMENT Technology Summary Report, Mar. 1978 - Oct. 1979
Robert E. Henderson, ed. and A. M. Mellor, ed. (Purdue Univ.) Dec. 1979 31 p refs
(AF Proj. 3066)
(AD-A080748; AFAPL-TR-79-2115) Avail: NTIS HC A03/MF A01 CSCL 21/2

This report summarizes the finding of an assessment. Section 1 provides a general introductory overview of the state-of-combustion-technology today and highlights some general projections and trends for the future. Section 2 gives a state-of-the-art review of the five special topic areas of interest covered during the assessment - main burners, afterburners, combustion modeling, structural and mechanical design, and alternative fuels. Sections 3 and 4 examine the advanced technology trends and projected technology needs, respectively, as related to each of the topic areas cited above. A five-year technology plan is outlined in section 5. Future aircraft propulsion requirements call for combustion systems capable of (1) accepting greater variations in compressor discharge pressure temperature and airflow; (2) producing heat release rates and temperature rises which will ultimately approach stoichiometric levels; and (3) providing high operational reliability and improved component durability, maintainability and repairability. In addition, the new requirements associated with exhaust emissions and fuel flexibility must be addressed. Consequently, as the combustor designer is confroneted with the new requirements of the future, especially exhaust emissions and fuel flexibility, new design concepts may be required to provide an acceptable solution. GRA

N80-23324# Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
DEVELOPMENT OF HIGH TEMPERATURE RESISTANT CERAMIC PARTS FOR GAS TURBINES Final Report
Wolfgang Krueger, Bernd Kugenbuch, Walter-Hans Peschel, and Wilhelm Siebmanns Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1979 54 p refs In GERMAN; ENGLISH summary
(Contract BMFT-NTS-19)
(BMFT-FB-T-79-09) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 10,90

Ceramic materials were used to produce an automobile gas turbine engine which is capable of operating at temperatures of up to 1400 C. The flame tube, turbine inlet cone, and turbine nozzle assembly were fabricated entirely of ceramics. The turbine rotor consisted of ceramic blades and a metal disc. Extensive tests were performed under conditions similar to those expected in automobile applications. Author (ESA)

N80-23325# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THREE DIMENSIONAL FLOW INVESTIGATION WITH A METHOD OF CHARACTERISTICS IN THE INLET REGION AND THE BLADE-TO-BLADE CHANNELS OF SUPERSONIC AXIAL COMPRESSORS Thesis - Paris VI Univ.
Jean Martinon 1979 205 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-637)
(ONERA-NT-1979-1; ISSN-0078-379X) Avail: NTIS HC A10/MF A01

A three dimensional method of characteristics was developed for the calculation of the supersonic flow in the inlet region and the blade to blade channels of blade cascades and high transonic axial flow compressors with subsonic or supersonic axial velocity. The numerical scheme is described and example calculations on several linear or annular cascades and rotating blade rows are presented. Author (ESA)

N80-23513*# Pratt and Whitney Aircraft, East Hartford, Conn. Government Products Div.
F100 EXHAUST NOZZLE AREA CONTROL
Joseph R. Kozlin *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 211-223 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 21E

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N80-23326*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

NAVIGATION, GUIDANCE, AND CONTROL FOR HELICOPTER AUTOMATIC LANDINGS

James R. Kelly and Frank R. Niessen May 1980 58 p refs (NASA-TP-1649; L-13454) HC A04/MF A01 CSCL 01C

A navigation, guidance and control concept was developed for helicopter automatic approach and landings. The algorithms employed were implemented in an airborne digital computer installed on a CH-47B research helicopter. Data are presented to illustrate system performance during fully automatic approach and landings in a variety of wind conditions. A.W.H.

N80-23327*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.

PRECISION CONTROLLABILITY OF THE YF-17 AIRPLANE

Thomas R. Sisk and Neil W. Mataeny May 1980 34 p refs (NASA-TP-1677; H-1089) Avail: NTIS HC A03/MF A01 CSCL 01C

A flying qualities evaluation conducted on the YF-17 airplane permitted assessment of its precision controllability in the transonic flight regime over the allowable angle of attack range. The precision controllability (tailchase tracking) study was conducted in constant-g and windup turn tracking maneuvers with the command augmentation system (CAS) on, automatic maneuver flaps, and the caged pipper gunsight depressed 70 mils. This study showed that the YF-17 airplane tracks essentially as well at 7 g's to 8 g's as earlier fighters did at 4 g's to 5 g's before they encountered wing rock. The pilots considered the YF-17 airplane one of the best tracking airplanes they had flown. Wing rock at the higher angles of attack degraded tracking precision, and lack of control harmony made precision controllability more difficult. The revised automatic maneuver flap schedule incorporated in the airplane at the time of the tests did not appear to be optimum. The largest tracking errors and greatest pilot workload occurred at high normal load factors at low angles of attack. The pilots reported that the high-g maneuvers caused some tunnel vision and that they found it difficult to think clearly after repeated maneuvers. Author

N80-23328*# Systems Technology, Inc., Hawthorne, Calif.

PRACTICAL OPTIMAL FLIGHT CONTROL SYSTEM DESIGN FOR HELICOPTER AIRCRAFT. VOLUME 1: TECHNICAL REPORT

L. G. Hofmann, Susan A. Riedel, and Duane McRuer May 1980 273 p refs (Contract NAS2-9946) (NASA-CR-3275; TR-1127-1-I) Avail: NTIS HC A12/MF A01 CSCL 01C

A method by which modern and classical theory techniques may be integrated in a synergistic fashion and used in the design of practical flight control systems is presented. A general procedure is developed, and several illustrative examples are included. Emphasis is placed not only on the synthesis of the design, but on the assessment of the results as well. R.C.T.

N80-23329# Army Missile and Munitions Center and School, Redstone Arsenal, Ala. Guidance and Control Directorate.

THEORY OF DISTURBANCE-UTILIZING CONTROL WITH APPLICATION TO MISSILE INTERCEPT PROBLEMS

William C. Kelly 12 Dec. 1979 327 p refs (AD-A081110; DRSMI/RG-80-11) Avail: NTIS HC A17/MF A01 CSCL 12/1

Control problems with disturbances which have waveform structure may be addressed by considering the maximum utilization mode of disturbance-accomodating control theory. It is shown in this work that the optimal utilization of disturbances can lead to significantly better performance than that of the 'optimal' linear-quadratic regulator. The conditions for the existence of a steady-state disturbance-utilizing control law are derived. It is shown that the steady-state control gains when they exist, are solutions of certain matric algebraic equations. Steady-state gain expressions are derived for several first and second order plants. Results are presented for the cases of optimal disturbance-utilizing control of an air-defense interceptor missile and of a missile homing on a fixed target, which demonstrate performance superior to that obtained by a conventional 'optimal' linear-quadratic missile controller. GRA

N80-23330# European Space Agency, Paris (France).

DEFINITION OF A TWO-LEVEL CONTROL SYSTEM FOR NONLINEAR MOTION OF AN AIRCRAFT

Albert Kirszenblat (Technion - Israel Inst. of Tech.) Feb. 1980 36 p refs Transl. into ENGLISH of "Calcul d'un Systeme de Commande a Deux Niveaux du Movement non Lineaire d'un Avion", Rept. ONERA-P-1979-7 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-22364 (ESA-TT-614; ONERA-P-1979-7) Avail: NTIS HC A03/MF A01

An approach to the problem of defining a control law well adapted to the whole flight envelope is presented. This system has a two level structure alloWing a task-oriented control and an augmentation of the aircraft stability. A nonlinear model of the aircraft dynamics incorporating the inertial coupling terms and the nonlinear aerodynamic effects constitute the first control level. The model generates a trajectory, a reference control law vector, and an output vector which follows a vector, representing the maneuvering objectives assigned by the pilot at any time. At the second level, a servo compensation subordinates the aircraft motion to the model. The control law is obtained by applying optimal linear control theory to local models of the aircraft. Direct force control surfaces may be easily incorporated into the computation of the control system. This system ensures an automatic and smooth coordination of the aircraft motions and of the deflection of the aerodynamic control surfaces along the pitch, roll and yaw axes, even under extreme flight conditions; it is particularly adapted to the case of high-performance fighter aircraft. Author (ESA)

N80-23331# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

DESIGN, DEVELOPMENT AND IMPLEMENTATION OF AN ACTIVE CONTROL SYSTEM FOR LOAD ALLEVIATION FOR A COMMERCIAL TRANSPORT AIRPLANE

R. F. OConnell (Lockheed-California Co., Burbank) Feb. 1980 21 p refs Presented at the 49th Struct. and Mater. Panel Meetings, Porz-Wahnm, West Germany, Oct. 1979 (AGARD-AR-683; ISBN92-835-1348-7) Avail: NTIS HC A02/MF A01

An active control system for load alleviation was developed for a long range version of the Lockheed L-1011. This system which permits the use of an extended wing span for fuel conservation with minimum structural change, will be introduced into commercial service in early 1980. The system is described and the criteria to which it is of the system installed on the flight test data obtained from a prototype version of the system installed on the flight airplane are presented, and comparsions of these results with analytical predictions are shown. A basis for certification of such systems is presented, assuring a level of safety equivalent to that of a conventional design. R.E.S.

N80-23512*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A SPIN-RECOVERY PARACHUTE SYSTEM FOR LIGHT GENERAL-AVIATION AIRPLANES

Charles F. Bradshaw *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 195-209 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N80-23332*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TWINTAN: A PROGRAM FOR TRANSONIC WALL INTERFERENCE ASSESSMENT IN TWO-DIMENSIONAL WIND TUNNELS

William B. Kemp, Jr. May 1980 40 p refs
(NASA-TM-81819) Avail: NTIS HC A03/MF A01 CSCL 14B

A method for assessing the wall interference in transonic two dimensional wind tunnel test was developed and implemented in a computer program. The method involves three successive solutions of the transonic small disturbance potential equation to define the wind tunnel flow, the perturbation attributable to the model, and the equivalent free air flow around the model. Input includes pressure distributions on the model and along the top and bottom tunnel walls which are used as boundary conditions for the wind tunnel flow. The wall induced perturbation fields is determined as the difference between the perturbation in the tunnel flow solution and the perturbation attributable to the model. The methodology used in the program is described and detailed descriptions of the computer program input and output are presented. Input and output for a sample case are given. J.M.S.

N80-23333*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

CRYOGENIC WIND TUNNELS: A SELECTED, ANNOTATED BIBLIOGRAPHY

Marie H. Tuttle and Robert A. Kilgore May 1980 15 p
(NASA-TM-80168) Avail: NTIS HC A02/MF A01 CSCL 14B

This annotated supplement updates the cryogenic wind tunnel bibliography. The entries continue the numbering begun in the first publication and run from 125 through 167. R.E.S.

N80-23334# Air Force Human Resources Lab., Brooks AFB, Tex. Flying Training Div.

PLATFORM MOTION CONTRIBUTIONS TO SIMULATOR TRAINING EFFECTIVENESS. STUDY 3: INTERACTION OF MOTION WITH FIELD-OF-VIEW Final Report

Mark Nataupsky, Wayne L. Waag, Douglas C. Weyer, Robert W. McFadden, and Edward McDowell Nov. 1979 31 p refs (AF Proj. 1123)
(AD-A078426; AFHRL-TR-79-25) Avail: NTIS HC A03/MF A01 CSCL 05/9

The objective was to determine the effects of platform motion cueing, visual field of view (FOV), and their interaction upon learning in the simulator and as subsequent transfer of training to the aircraft for basic contact maneuvers in the T-37 aircraft. A transfer of training study design was used in which student pilots were initially trained in the Advanced Simulator for Pilot Training (ASPT) and subsequently evaluated on their first sortie in the T-37 aircraft. Each student received training under one of four simulator configurations: (1) full platform motion (six degrees-of-freedom), full FOV (300 degrees horizontal by 150 degrees vertical; (2) full platform motion, limited FOV (48 degrees by 36 degrees vertical); (3) no platform motion, full FOV; and (4) no platform motion, limited FOV. For the ASPT pretraining phase, scores from the automated performance measuring system and overall instructor pilot ratings were used for analysis. For the T-37 evaluation sorties, the overall instructor pilot ratings, as well as individually recorded flight parameters, were analyzed. These data provided no conclusive evidence of differential transfer effects resulting from platform motion cueing, size of the visual FOV, or their interaction. As such, these data provide support for previous findings that platform motion cueing does not significantly enhance the transfer of learning for basic contact tasks in the T-37 aircraft. It would seem that the impact of peripheral visual cues for initial acquisition is not critical. Furthermore, no convincing evidence was found indicating increased transfer using platform motion in conjunction with a narrow FOV visual scene. GRA

N80-23335# Naval Air Development Center, Warminster, Pa. Software and Computer Directorate.

NAVAIRDEVCEN DYNAMIC FLIGHT SIMULATOR DESIGN AND MULTIPURPOSE CREW STATION CONCEPT DESIGN AND DEVELOPMENT PLAN Final Report

G. Terry Thomas 1 Nov. 1979 68 p refs
(AD-A081982; NADC-80019-50) Avail: NTIS HC A04/MF A01 CSCL 14/2

Chemical reactions important in molecular lasers were studied with a special emphasis on atomic recombinations and on dissociation of diatomic molecules. The experiments involved flash photolysis and shock wave techniques. The results were explained in terms of 3-D trajectory calculations. GRA

N80-23336# Canyon Research Group, Inc., Westlake Village, Calif.

AIR COMBAT MANEUVERING PERFORMANCE MEASUREMENT

Michael J. Kelly, Lee Wooldridge, Robert T. Hennessy, Donald Vreuls, and Steve F. Barnebey Sep. 1979 140 p refs
(Contract F33615-77-C-0079; AF Proj. 1123)
(AD-A077429; NAVTRAEQUIPC-IH-315; AFHRL-TR-79-3) Avail: NTIS HC A07/MF A01 CSCL 05/9

A study was conducted to define measures of Air Combat Maneuvering (ACM) for one-versus-one (lvl) free engagements on the Simulator for Air-to-Air Combat (SAAC). The study found a small set of measures which were (1) sensitive to differences in pilot ACM skill level; (2) diagnostic of performance proficiencies and deficiencies; (3) usable by instructor pilots and compatible with their judgments; (4) capable of providing results immediately after the end of the engagement; and (5) compatible with current projected training measurement hardware. The study was conducted in three phases. Phase 1 was an analytical study of ACM tasks using information from training material and instructor pilots; 28 measures reflected subject matter experts opinion on the important elements of ACM. Pilot control, aircraft performance and engagement outcome variables were measured in phase 2 during 405 free engagements on the SAAC at Luke AFB using a total of 30 pilots with three different levels of experience. A computer analysis of the engagement data was conducted in phase 3 to (1) check methodological assumptions that the three pilot experience levels represented different ACM skill levels and (2) develop the smallest comprehensive measure set. GRA

N80-23337# Rolls-Royce Ltd., Derby (England).

INVESTIGATION INTO COMPRESSOR AEROELASTIC INSTABILITIES IN A WIND TUNNEL FOR A RECTILINEAR CASCADE OF BLADES

Edmond Szechenyi (ONERA, Paris), Henri Loiseau (ONERA, Paris), and Brigitte Maquennehan (ONERA, Paris) 1979 14 p refs Transl. into ENGLISH of conf. paper "Etude des Instabilites Aeroelastiques des Compresseurs en Souffierie de Grille Rectiligne d'Aubes", Rept. AGARD-CP-248 AGARD In ENGLISH and FRENCH Presented at AGARD/PEP Symp.: Stresses, Vibration, Engine Integration and Engine Integrity, Cleveland, 23-27 Oct. 1978
(PNR-90011; Trans-14190; AGARD-CP-248) Avail: NTIS HC A02/MF A01

The nature of the problems of aeroelastic stability in compressors is reviewed, and the wind tunnel for rectilinear cascades at ONERA is described. The installation simulates as closely as possible the conditions in the actual engines studied: compression ratio (or incidence), Mach number, and corrected frequency. The measurement methods are discussed, and test results presented which show the character of the aeroelastic instabilities in a subsonic and transonic flow. Author (ESA)

N80-23338# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

COMPARATIVE MEASUREMENTS IN FOUR EUROPEAN WIND TUNNELS OF THE UNSTEADY PRESSURES ON AN OSCILLATING MODEL

N. Lambourne (Royal Aircraft Establishment, Bedford, England), R. Destuynder (ONERA, Paris), K. Kienappel, and R. Roos Feb. 1980 50 p refs Presented at the 49th Struct. and Mater. Panel Meeting, Porz-Wahn, West Germany, Oct. 1979
(AGARD-R-673; ISBN-92-835-1346-0) Avail: NTIS HC A03/MF A01

The effects of the walls of a wind tunnel on the behavior of dynamic models used for flutter certification of aircraft were investigated. Tests were completed in four European wind tunnels

and the results were analyzed. The results and conclusions are summarized. R.E.S.

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N80-23339*# Georgetown Univ., Washington, D.C. Space Utilization Team.
A STUDY OF THE POTENTIAL IMPACTS OF SPACE UTILIZATION Final Report
T. Stephen Cheston, Charles M. Chafer, Sallie B. Chafer, David C. Webb, and Courtney A. Stadd Sep. 1979 144 p refs
(Contract NASw-3152)
(NASA-CR-163131) Avail: NTIS HC A07/MF A01 CSCL 22A

Because the demand for comprehensive impact analysis of space technologies will increase with the use of space shuttles, the academic social sciences/humanities community was surveyed in order to determine their interests in space utilization, to develop a list of current and planned courses, and to generate a preliminary matrix of relevant social sciences. The academic scope/focus of a proposed social science space-related journal was identified including the disciplines which should be represented in the editorial board/reviewer system. The time and funding necessary to develop a self-sustaining journal were assessed. Cost income, general organizational structure, marking/distribution and funding sources were analyzed. Recommendations based on the survey are included. A.R.H.

N80-23340*# National Aeronautics and Space Administration, Washington, D. C.
PRELAUNCH SUMMARY: NOAA-B LAUNCH
13 May 1980 6 p
(NASA-TM-81060; Summ-E-615-80-02) Avail: NTIS HC A02/MF A01 CSCL 22A

The NOAA-B satellite will launch from the Western Test Range into Sun-synchronous orbit to replace the TIROSN-satellite as part of the national operational environmental satellite system in support of the Global Atmospheric Research Program and the World Weather Watch. The mission objectives, primary environmental sensors, launch particulars, flight sequence of events, mission support, and project costs for NOAA-A through NOAA-G are discussed. NASA's responsibilities include launch, in-orbit evaluation and spacecraft checkout. A.R.H.

N80-23341*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM STANDARD MANEUVER SEQUENCES FOR ORBITER/UPPER-STAGE SEPARATION SSUS-A, SSUS-D, AND IUS
S. W. Wilson Apr. 1980 187 p refs Prepared in cooperation with TRW Systems, Houston, Tex.
(NASA-TM-81058; JSC-16508; Rept-80-FM-22) Avail: NTIS HC A09/MF A01 CSCL 22A

Descriptions of standard post-ejection maneuver sequences for the deployment of IUS, SSUS-A, and SSUS-D upper stages from the space shuttle orbiter are presented. The sequences were designed to satisfy requirements for limiting the damage inflicted on the orbiter by upper-stage exhaust particles, subject to a further requirement for minimizing the impingement of orbiter thruster plumes on the deployed payload. In all cases it was assumed that the orbital maneuvering system engines would be used to apply the orbiter's major separation velocity increment. R.E.S.

N80-23342# Technische Universitaet, Munich (West Germany). Lehrstual fuer Raumfahrttechnik.
THE MATHEMATICIAN GAUSS, SEEN FROM THE POINT OF VIEW OF A SPACE TECHNOLOGIST [GAUSS UNTER DEM BLICKWINKEL EINES RAUMFAHRTTECHNIKERS]
Harry O. Ruppe Mar. 1977 16 p refs In GERMAN
(TUM-LRT-KB-14/77) Avail: NTIS HC A02/MF A01

A biography of Carl Friedrich Gauss is presented, emphasizing his influence on modern science. His contributions to measuring techniques, planetary theory, celestial mechanics, orbit determination, differential geometry, relativity theory and the least squares method are discussed. Author (ESA)

N80-23343# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Preprojects and Studies Dept.
AUTOMATIC SPACE PROCESSING EQUIPMENT (ASPE), PRE-PHASE A STUDY. VOLUME 1: TECHNICAL SUMMARY
H. D. Bruhn, J. Geisel, R. Krieger, U. Laux, I. Meyer, T. Miski, H. Stolze, and H. Stegen 10 Oct. 1979 93 p 3 Vol.
(Contract ESA-3910/79-F-FC(SC))
(PRV-3-6/79-Vol-1; ESA-CR(P)-1293-Vol-1) Avail: NTIS HC A05/MF A01

The initial automatic SL-Pallet concepts for material sciences (Automatic Space Processing Pallet Equipment = ASPE) were studied. Typical experiments and available equipment from which the performance limits and the basic equipment are derived were investigated. One reference payload for a shuttle flight was investigated for accomodation. For this payload, a preforred overall concept was established. Planning and cost estimation for development, manufacturing and integration of the experiment facilities, and a cost estimation (total and proportionate) for a reference mission were performed. Author (ESA)

N80-23344# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Preprojects and Studies Dept.
AUTOMATIC SPACE PROCESSING EQUIPMENT (ASPE), PRE-PHASE A STUDY. VOLUME 2: TECHNICAL APPENDIX
H. D. Bruhn, J. Geisel, R. Krieger, U. Laux, I. Meyer, T. Miski, H. Stolze, and H. Stegen 10 Oct. 1979 373 p 3 Vol.
(Contract ESA-3910/79-F-FC(SC))
(PRV-3-6/79-Vol-2; ESA-CR(P)-1292-Vol-2) Avail: NTIS HC A15/MF A01

The initial automatic SL-Pallet concepts for material sciences (Automatic Space Processing Pallet Equipment = ASPE) were studied. Typical equipment and available equipment from which the performance limits and the basic equipment are derived were investigated. Several experiment facilities and the necessary support equipment were defined. One reference payload for a shuttle flight was investigated for accommodation. Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N80-23345 Texas Univ. at Austin.
STATE AND PARAMETER ESTIMATION FOR REENTRY VEHICLE LATERAL MOTION Ph.D. Thesis
Jerry Louis McDowell 1979 174 p
Avail: Univ. Microfilms Order No. 8009895

A four state dynamical model of reentry vehicle motion was used in a weighted least squares batch estimation algorithm to determine the angular motion and aerodynamic coefficients for a trajectory of known velocity, dynamic pressure, and roll rate. A model was proposed for the time variation of the aerodynamic coefficients. Simulated accelerometer and gyro measurements were processed to estimate the unknown states and coefficients. A second order measurement model was developed to account for the dynamic response characteristics of onboard measurement sensors in the presence of reentry vehicle oscillatory behavior. Examples are provided which illustrate the feasibility of the four state dynamical model and second order measurement model in reentry vehicle estimation problems.
Dissert. Abstr.

N80-23346*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
EARTH ORBITAL EXPERIMENT PROGRAM AND REQUIREMENTS STUDY Summary Report, 2 Sep. 1969 - 9 Apr. 1971
Apr. 1971 112 p
(Contract NAS1-9464)
(NASA-CR-162132; MDC-G0788) Avail: NTIS

HC A06/MF A01 CSCL 22A

A compilation of Earth orbital experiments and their required support technological developments is given. Six disciplines including manned spaceflight capability, space biology, spce astronomy, space physics, communications and navigation, and Earth observations were subjected to an overview analysis that resulted in the identifiying of 3,800 critical issues. Of these critical issues, 1,983 that were deemed suitable for near-term manned space research were grouped into 136 research clusters in accordance with commonality of instrumentation and measurements. These clusters are described at a level of detail that identifies the important aspects of the research and establishes the principal requirements that will be placed on the missions in accomplishing the research and on the space research facilities for these missions. Summaries of the space facility requirements and guidelines for mission planning are given. The supporting technology developments required to pursue the research are identified and grouped into 233 work packages. M.G.

N80-23347# Aerospace Defense Command, Peterson AFB, Colo. Office of Astrodynamics.

GENERAL PERTURBATIONS THEORIES DERIVED FROM THE 1965 LANE DRAG THEORY

Max H. Lane and Felix R. Hoots Dec. 1979 64 p refs

(AD-A081264; ASTRODYNAMIC-2) Avail: NTIS HC A04/MF A01 CSCL 22/3

The Air Force General Perturbation theory (AFGP4) based on the analytic satellite theory of Lane (1965) and Lane and Cranford (1969) which models the gravitational zonal harmonics through J5 and models the atmosphere with a spherically symmetric power density function is given here in its complete form. All equations needed for satellite prediction are given and the reader is referred to the original publications for theoretical background. Two simplified equation subsets (IGP4 and SGP4) of AFGP4 are also given and the procedure by which they were obtained is outlined. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *05 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N80-23348*# Rice Univ., Houston, Tex.

ELECTROSTATIC PROTECTION OF THE SOLAR POWER SATELLITE AND RECTENNA

John W. Freeman, Arthur A. Few, Jr., Patricia H. Reiff, David Cooke, Jerry Bohannon, and Bob Haymes May 1979 157 p (Contract NAS8-33023)

(NASA-CR-161438) Avail: NTIS HC A08/MF A01 CSCL 22B

Several features of the interactions of the solar power satellite (SPS) with its space environment were examined theoretically. The voltages produced at various surfaces due to space plasmas and the plasma leakage currents through the kapton and sapphire solar cell blankets were calculated. At geosynchronous orbit, this parasitic power loss is only 0.7%, and is easily compensated by oversizing. At low-Earth orbit, the power loss is potentially much larger (3%), and anomalous arcing is expected for the EOTV high voltage negative surfaces. Preliminary results of a three dimensional self-consistent plasma and electric field computer program are presented, confirming the validity of the predictions made from the one dimensional models. Magnetic shielding of the satellite, to reduce the power drain and to protect the solar cells from energetic electron and plasma ion bombardment is considered. It is concluded that minor modifications can allow the SPS to operate safely and efficiently in its space environment. The SPS design employed in this study is the 1978 MSFC baseline design utilizing GaAs solar cells at CR-2 and an aluminum structure. A.R.H.

N80-23349# Logicon, Inc., Lexington, Mass.

FUNCTIONAL AND OPERATIONAL ADVANCES IN THE AFGL ROCKET TRAJECTORY SYSTEM-I Interim Report

Krishin H. Bhavnani and Edward C. Robinson Hanscom AFB, Mass. AFGL 15 Jul. 1979 67 p refs

(Contract F19628-78-C-0209; AF Proj. 9993)

(AD-A081447; AFGL-TR-79-0183; SR-1) Avail: NTIS HC A04/MF A01

The present AFGL Rocket Trajectory System consists of an editor-preprocessor of radar data, a comprehensive multi-functional filtering and trajectory estimation program, a multi-radar estimation program, and a report generator. Several analytical and organizational procedures have been developed to enhance the capabilities of this system. A usage guide, a program guide and appendices describe these advances. GRA

N80-23350# Emmanuel Coll., Boston, Mass.

ENERGETIC PARTICLE STUDIES: INSTRUMENTATION AND ANALYSIS Final Report, 1 Apr. 1978 - 31 Mar. 1979

W. Bellew, A. Davis, M. P. Hagan, E. Holeman, A. Huber, J. Pantazis, D. Parsignault, Y. V. Rao, and R. Vesprini Hanscom AFB, Mass. AFGL Sep. 1979 164 p refs

(Contract F19628-76-C-0039; AF Proj. 2311)

(AD-A081714; AFGL-TR-79-0223) Avail: NTIS HC A08/MF A01 CSCL 22/2

The general objectives of the program reported in this document were the implementation and support of research directed toward measurements of the energetic charged particle environment in near-Earth space. Specific objectives were the design, construction and calibration of instrument packages for the U.S. Air Force Satellites dmsp Flights Number 2, 3, 4 and 5 and P78-1, and field support for the same missions the study of the response, through computer and laboratory simulations, of existing proton-telescopes to the natural radiation environment the data analysis of proton data obtained from previous satellite missions finally, the preliminary study and design of a charged particle telescope. GRA

N80-23351# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.

AERODYNAMIC COMPUTER CODE FOR COMPUTING PRESSURE LOADS ON A MISSILE AT HIGH SUPERSONIC SPEEDS AND GENERALIZED ALTITUDES Final Report, 1 Oct. 1978 - 31 Nov. 1979

Kenneth K. Wang Dec. 1979 225 p refs

(Contract N60921-78-C-0203)

(AD-A081596; MDC-G8223) Avail: NTIS HC A10/MF A01 CSCL 09/2

An aerodynamic computer code was developed for calculating the pressure distribution on a missile or its components, e.g., body and wings and subsequently interpolating the results by surface fit at locations as specified for structural analysis using the NASTRAN computer code. The code is valid for high supersonic speeds and generalized attitudes of the missile. GRA

N80-23352# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.

FEASIBILITY STUDY OF A SPACELAB-SUBSATELLITE

Juergen Puls Dec. 1977 206 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-559)

(DLR-FB-77-67) Avail: NTIS HC A10/MF A01; DFVLR, Cologne DM 87,20

The feasibility of constructing a small inexpensive subsatellite for use in connection with the space shuttle program is

discussed. The satellite is designed to carry out various scientific experiments in orbits that are independent of the main space laboratory. A modular concept characterizes the design. Special emphasis is placed on the investigation of orbital mechanics.
Author (ESA)

N80-23353# Societe Nationale Industrielle Aerospatiale, Cannes (France).
COSMOS. METEOSAT: METEOROLOGICAL DATA DISTRIBUTION (MDD) ON METEOSAT Final Report [COSMOS. METEOSAT: MDD SUR METEOSAT]
R. Verdin 25 Jun. 1979 202 p refs In FRENCH
(Contract ESA-3828/79-F-CG(SC))
(Rept-2786/85-TEA; ESA-CR(P)-1283) Avail: NTIS HC A10/MF A01

The possibility of implementing meteorological data distribution (MDD) on a future Meteosat was examined. Three options were studied, a linear repeater, a regenerative repeater with separate power amplifier, and a regenerative repeater using the power amplifier of the Meteosat. Reasons for the choice of the second are elaborated. Methods for increasing the output of the solar generator on Meteosat and the power of the S band amplifier are reviewed. A study of the MDD regenerative transmitter is presented, along with a discussion of perturbations caused by a mechanically despun antenna on Meteosat. An evaluation was made of the electronic despun antenna in Rx mode relative to the performance of the Meteosat EDA. Author (ESA)

N80-23354# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
DETERMINATION OF BOUNDARIES FOR KINEMATIC INTERCEPT REGIONS AND EVALUATION OF THE MISS DISTANCE FOR LINE-OF-SIGHT (LOS)-GUIDED MISSILES
Winfried Hofmann Mar. 1979 79 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-626)
(DFVLR-FB-79-13) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 15.40

The kinematic and dynamic behavior of a guided missile is calculated in terms relating to initial and feedback correction. Requirements on the angle between visual sight line and trajectory as well as on the lateral acceleration of the missile are deduced from the kinematics of motion. The boundaries of kinematic intercept regions are presented. A linearized time dependent dynamic deviation model is used to evaluate the miss distance in terms of missile dynamics and initial errors. Author (ESA)

N80-23355# British Aerospace Dynamics Group, Stevenage (England).
ON THE ADVANCED POWER SYSTEM CONFIGURATION STUDY
J. E. Haines, comp. (British Aerospace Dyn. Group, Stevenage, England) Jun. 1979 231 p refs
(Contract ESA-3387/77-NL-HP(SC))
(TP-7753; ESA-CR(P)-1290) Avail: NTIS HC A11/MF A01

Payload power requirements were reviewed for four applications satellite missions: aircraft communications; maritime communications; commercial communications; and TV broadcast; in order to define power subsystem configurations and identify areas where the maximum reuse of hardware can be achieved. A modular design approach was directed at these areas and the conceptual modular designs interpreted into circuit schematics. Author (ESA)

N80-23356# General Technology Systems Ltd., London (England).
A STUDY OF INCREASED RELIABILITY AND LIFETIMES FOR FUTURE COMMUNICATIONS SATELLITES, VOLUME 1 Summary Report
G. E. Hall, comp. and A. I. Naylor, comp. Oct. 1979 23 p 2 Vol.
(Contract ESA-3925/79-NL-AB(SC))
(GTS-790174-Vol-1; ESA-CR(P)-1291-Vol-1) Avail: NTIS HC A02/MF A01

An analysis of the orbital life performance of 150 communications satellites was undertaken and supplemented by a literature search, an independent investigation of life limiting spacecraft elements, and visits to North American and European organizations, with the aim of improving cost effectiveness and service availability of communications satellites by extending design lifetimes to 10-15 years. It is shown that 20% of satellites failed to achieve full operational status in orbit. Satellites display a nonconstant failure rate consistent with extensive redundancy. Production expertise has matched the steady increase in design lifetimes which are, on an average, attained. A nine to ten year life is the present state of the art. Major satellites life limiters are: NiCd batteries (problems unsolved); TWTAs, radiation degradation, microwave transistors, inadequate parts screening, fuel depletion (requiring individual trade off decisions); design faults, command disabling, poor reduncancy, repeater electronics, power distribution, motors/bearings, bladders, thrusters, thermal cycle stresses, static discharging, microprocessor applications (requiring design/production control and further research).
Author (ESA)

N80-23357# General Technology Systems Ltd., London (England).
A STUDY OF INCREASED RELIABILITY AND LIFETIMES FOR FUTURE COMMUNICATIONS SATELLITES, VOLUME 2 Final Report
G. E. Hall, comp. and A. I. Naylor, comp. Oct. 1979 387 p refs 2 Vol.
(Contract ESA-3925/79-NL-AB(SC))
(GTS-790173-Vol-2; ESA-CR(P)-1291-Vol-2) Avail: NTIS HC A17/MF A01

An effort was undertaken to improve the cost effectness and service availability of communications satellites by extending design lifetimes to ten to fifteen years. A literature search containing over 200 references was directed primarily at the orbital performance of satellites. Appendices are presented covering the following areas: satellite orbital histories; confidence bounds for constant failure rates demonstrated by parts; and EEE part failure mechanisms. R.C.T.

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N80-23358# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Systems and Logistics.
SPACE TRANSPORTATION SYSTEM WESTERN LAUNCH SITE CONSTRUCTION MANAGEMENT INFORMATION SYSTEM: A CASE STUDY M.S. Thesis
G. Scott Griffin and James M. Mardis Sep. 1979 97 p refs
(AD-A077675; AFIT-LSSR-4-79B) Avail: NTIS HC A05/MF A01

The Corps of Engineers Management Information System (COEMIS) is used by the Corps of Engineers in their role as construction agents on Air Force projects built under the Military Construction Program. This research investigates the ability of COEMIS to meet Air Force informational needs by examining the construction management effort in progress on the Western Launch Site Space Transportation System Facilities at Vandenberg Air Force Base, California. The research concluded that the Corps of Engineers Management Information System can be an effective, efficient management tool which has the capability to meet Air Force needs provided: (1) implementation of real time computer interfaces, (2) Air Force participation in COEMIS, and (3) establishment of a split data base. The results of this study should be applicable to all major Air Force construction projects managed by the Army Corps of Engineers. GRA

N80-23359# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
LONG DURATION EXPOSURE FACILITY (LDEF): A NEW MULTIPURPOSE FREE-FLYING EXPERIMENT CARRIER
Eduard Igenbergs 1977 27 p refs In GERMAN Presented at Ann. DGLR Meeting, Berlin, 13-15 Sep. 1977
(TUM-LRT-KB-77/17) Avail: NTIS HC A03/MF A01

The construction, launch, and return environment of the long

duration exposure facility (LDEF) are described. Possible long-term experiments are discussed. Author (ESA)

N80-23360# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
SUGGESTED EXPERIMENTS FOR MOMENTUM-FREE G-SIMULATION USING THE LONG DURATION EXPOSURE FACILITY (LDEF) [EXPERIMENTEN VORSCHLAG EINER MOMENTENFREIEN G-SIMULATION FUER DEN EINSATZ IM DDEF]
D. Hayn and H. Steinberger Oct. 1978 18 p refs In GERMAN
(TUM-LRT-KB-77/18) Avail: NTIS HC A02/MF A01

An experiment is proposed which represents a torque-free simulation of the acceleration values 1 g, 1/3 g and 0 g. These are generated by two contrarotating cylindrical disks. The apparatus will fit in an experiment tray, and will be activated after the unloading of the carrier from the space shuttle. Author (ESA)

N80-23361# European Space Agency, Paris (France).
MODELING OF COUPLED HEAT TRANSFER BY RADIATION AND CONVECTION: APPLICATION TO SPACELAB SHORT MODULE [MODELISATION DES TRANSFERT THERMIQUES COUPLES PAR RAYONNEMENT ET CONVECTION: APPLICATION A LA CABINE DU SPACELAB]
J. B. Saulnier (Ecole Natl. Super. de Mecan. et d'Aerotech.), A. Alexandre (Ecole Natl. Super. de Mecan. et d'Aerotech.), and J. Martinet (Ecole Natl. Super. de Mecan. et d'Aerotech.) Oct. 1979 39 p refs In FRENCH
(ESA-STM-214: ISSN-0379-4075) Avail: NTIS HC A03/MF A01

A model of coupled heat transfer by radiation and forced convection was developed and applied to the Spacelab short module. The fundamental laws concerning emission and absorption of radiation in gases and gaseous mixtures are discussed. The Spacelab cabin was modelled using a cylindrical pipe in which a mixture of air, carbon dioxide, and water vapor flows at uniform velocity. The influence of zoning is demonstrated and the equations of combined heat transfer are solved for a step change in the input fluid temperature. Author (ESA)

N80-23496*# Boeing Aerospace Co., Seattle, Wash.
MECHANISMS TO DEPLOY THE TWO-STAGE IUS FROM THE SHUTTLE CARGO BAY
H. Theron Haynie *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 1-8 ref (For primary document see N80-23495 14-31)
(Contract F04701-78-C-0040)
Avail: NTIS HC A15/MF A01 CSCL 22B

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

No abstracts in this category.

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N80-23362*# Vought Corp., Dallas, Tex.
SPACECRAFT RADIATORS FOR ADVANCED MISSION REQUIREMENTS Final Report
J. W. Leach 23 Apr. 1980 134 p refs
(Contract NAS9-14778)
(NASA-CR-160589; Rept-2-30320/9R-52212) Avail: NTIS HC A07/MF A01 CSCL 22B

Design requirements for spacecraft heat rejection systems are indentified, and their impact on the construction of conventional pumped fluid and hybrid heat pipe/pumped fluid radiators is evaluated. Heat rejection systems to improve the performance or reduce the cost of the spacecraft are proposed. Heat rejection requirements which are large compared to those of existing systems and mission durations which are relatively long, are discussed. E.D.K.

N80-23363# SRI International Corp., Menlo Park, Calif.
CHEMICAL PHYSICS OF CHARGE MECHANISMS IN NONMETALLIC SPACECRAFT MATERIALS Final Report
Richard C. Adamo and Joseph E. Nanevicz May 1979 37 p refs
(Contract F49620-77-C-0113; AF Proj. 2303; SRI Proj. 6402)
(AD-A081487; AFOSR-80-0125TR) Avail: NTIS HC A03/MF A01 CSCL 22/2

The interactions of spacecraft and space systems with the changing solar illumination and charged-particle environments in the vacuum of space result in the occurrence of a number of electrostatic and electromagnetic phenomena. These phenomena, commonly referred to collectively as spacecraft charging effects, can produce undesirable and sometimes serious problems with the performance and operation of military, commercial and NASA spacecraft. This report explores the behavior of typical polymeric spacecraft surface materials under simulated orbital conditions to provide a better understanding of the electrostatic and electromagnetic charging and discharging processes associated with spacecraft charging phenomena. The results of the materials charging behavior studies provide an empirical measure of some of the complexities of materials behavior under dynamic conditions more typical of those encountered in space than are normally used in ground based simulations and indicate that many present laboratory simulation and measurement techniques may not provide data truly representative of actual in-orbit spacecraft charging effects. The results of the discharge characterization experiments indicate that electromagnetic transients caused by sample discharges produced signals in external sensors indicative of transient electric field changes of tens of kV/m at locations several inches from the sample boundaries. These transient electromagnetic signals can therefore be considered as extremely energetic sources of possible electromagnetic interference on spacecraft. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N80-23364*# Illinois Univ., Urbana. Aeronomy Lab.
A ROCKET-BORNE ENERGY SPECTROMETER USING MULTIPLE SOLID-STATE DETECTORS FOR PARTICLE IDENTIFICATION
K. L. Fries, L. G. Smith, and H. D. Voss 1 Dec. 1979 167 p refs

(Grant NGR-14-005-181)
(NASA-CR-153183; UILU-ENG-79-2510; Aeronomy-91; ISSN-0568-0581) Avail: NTIS HC A08/MF A01 CSCL 14B

A rocket-borne experiment using energy spectrometers that allows particle identification by the use of multiple solid-state detectors is described. The instrumentation provides information regarding the energy spectrum, pitch-angle distribution, and the type of energetic particles present in the ionosphere. Particle identification was accomplished by considering detector loss mechanisms and their effects on various types of particles. Solid state detectors with gold and aluminum surfaces of several thicknesses were used. The ratios of measured energies for the various detectors were compared against known relationships during ground-based analysis. Pitch-angle information was obtained by using detectors with small geometrical factors mounted with several look angles. Particle flux was recorded as a function of rocket azimuth angle. By considering the rocket azimuth, the rocket precession, and the location of the detectors on the rocket, the pitched angle of the incident particles was derived. R.E.S.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N80-23365*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COOLING OF HIGH PRESSURE ROCKET THRUST CHAMBERS WITH LIQUID OXYGEN
H. G. Price 1980 15 p refs Proposed for presentation at the 16th Joint Propulsion Conf., Hartford, 30 Jun. - 2 Jul. 1980; cosponsored by AIAA, ASME and SAE
(NASA-TM-81503; E-441) Avail: NTIS HC A02/MF A01 CSCL 21H

An experimental program using hydrogen and oxygen as the propellants and supercritical liquid oxygen (LOX) as the coolant was conducted at 4.14 and 8.274 MN/square meters (600 and 1200 psia) chamber pressure. Data on the following are presented: the effect of LOX leaking into the combustion region through small cracks in the chamber wall; and verification of the supercritical oxygen heat transfer correlation developed from heated tube experiments. A total of four thrust chambers with throat diameters of 0.066 m were tested. Of these, three were cyclically tested to 4.14 MN/square meters (600 psia) chamber pressure until a crack developed. One had 23 additional hot cycles accumulated with no apparent metal burning or distress. The fourth chamber was operated at 8.274 MN/square meters (1200 psia) pressure to obtain steady state heat transfer data. Wall temperature measurements confirmed the heat transfer correlation. R.C.T.

N80-23366# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.
SURVEILLANCE REPORT. STAGE 1, DISSECTED MOTORS, PHASE 11: PROPELLANT COMPONENT TESTING Semiannual Report
John A. Thompson Nov. 1979 96 p
(AD-A081535; MANCP-427(79)) Avail: NTIS HC A05/MF A01 CSCL 21/9

Testing was performed to determine the useful shelf/service life for LGM-30 Stage 1 Rocket Motors. A three year storage program for propellant and components was started in May 1961. This program was then extended to a ten year study and later continued indefinitely to assure that a deterioration in motor physical characteristics could be detected in time to take some corrective actions before the weapon system performance deteriorated below an acceptable level. This report covers only propellant data and limited case bond data. The malfunction of an environmental chamber destroyed component samples that had originally been part of this testing program (and the inadvertent burning of some motors during dissection reduced the material available for testing). Planned dissection of selected motors in the future will provide samples for continued component testing. The data from this test period was combined with data from previous testing and entered into the G085 computer for storage, analysis, and regression analysis. From the statistical analysis of all data tested to date, significant degradation of the propellant does not appear likely for at least two years past the oldest data point. GRA

N80-23367# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A MICROPROCESSOR-BASED INSTRUMENT FOR STATIC TESTING SMALL ROCKET ENGINES M.S. Thesis
Arthur Houghton Barber, III Sep. 1979 105 p refs
(AD-A081083) Avail: NTIS HC A06/MF A01 CSCL 14/2

A microprocessor-based instrument was developed for static testing solid-fuel rocket engines having peak thrusts of 130 Newtons or less and total impulses of up to 100 Newton-seconds. It measured peak thrust, total impulse, burn time, pyrotechnic delay time, and maximum casing external temperature, all to relative accuracies of two percent of the smallest expected values. This corresponds to better than 0.1 percent of full scale. The instrument was designed for minimum parts cost and for portable operation from two twelve-volt batteries. It may be easily modified to test engines with five to ten times greater thrusts and total impulses. GRA

N80-23368# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
COST ANALYSIS OF THE PROPULSION OF A PAYLOAD TRANSFER MODULE FOR SHUTTLE/SPACELAB APPLICATIONS ON THE BASIS OF HYBRID ROCKET ENGINES [UNTERSUCHUNGEN UEBER DIE KOSTEN DES ANTRIEBS EINES NUTZLASTTRANSFERMODULS FUER RAUMTRANSPORTER/RAUMLABORATORIUM-ANWENDUNGEN AUF BASIS VON ZWEISTOFFTRIEBWERKEN]
Robert H. Schmucker 28 Sep. 1977 25 p refs In GERMAN
(TUM-LRT-KB-77/19) Avail: NTIS HC A02/MF A01

Design alternatives are considered for an autonomous three axis stabilized propulsion platform for use with space shuttle/Spacelab. An optimal configuration is presented, based on subsystem choices. Author (ESA)

N80-23507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN AND DEVELOPMENT OF THE QUAD REDUNDANT SERVOACTUATOR FOR THE SPACE SHUTTLE SOLID ROCKET BOOSTER THRUST VECTOR CONTROL
James M. Lominick *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 125-141 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 21H

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N80-23369# National Materials Advisory Board, Washington, D. C.
SCIENCE BASE FOR MATERIALS PROCESSING: SELECTED TOPICS Final Report
Nov. 1979 143 p refs
(Contract MDA903-78-C-0038)
(PB80-122948; NMAB-355) Avail: NTIS HC A07/MF A01 CSCL 05A

The highlights of a workshop on four selected topics, namely, high speed metal removal, metal deformation processing, advanced composites, and high modulus polymers are presented. Areas of materials processing are identified that could benefit from an improved science base. Scientific information to be obtained for each process are defined to achieve technological and economic improvements. Institutional problems are explored that must be overcome to achieve greater academic participa-

tion in processing science and more effective industry-university interaction. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N80-23370*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENGINE ENVIRONMENTAL EFFECTS ON COMPOSITE BEHAVIOR
C. C. Chamis and G. T. Smith 1980 20 p refs Presented at the 21st Struct., Structural Dyn. and Mater. Conf., Seattle, 12-14 May 1980; sponsored by AIAA, ASME, ASCE, and AHS (NASA-TM-81508; E-446) Avail: NTIS HC A02/MF A01 CSCL 11D

A series of programs were conducted to investigate and develop the application of composite materials to turbojet engines. A significant part of that effort was directed to establishing the impact resistance and defect growth chracteristics of composite materials over the wide range of environmental conditions found in commercial turbojet engine operations. Both analytical and empirical efforts were involved. The experimental programs and the analytical methodology development as well as an evaluation program for the use of composite materials as fan exit guide vanes are summarized. R.C.T.

N80-23371*# Lockheed-California Co., Burbank.
FLIGHT SERVICE EVALUATION OF KEVLAR-49 EPOXY COMPOSITE PANELS IN WIDE-BODIED COMMERCIAL TRANSPORT AIRCRAFT Annual Flight Service Report, Jan. - Dec. 1979
R. H. Stone Mar. 1980 43 p refs
(Contract NAS1-11621)
(NASA-CR-159231; AFSR-6) Avail: NTIS HC A03/MF A01 CSCL 11D

Kevlar-49 fairing panels, installed as flight service components on three L-1011s, were inspected after 6 years' service. The Kevlar-49 components were found to be performing satisfactorily in service with no major problems, or any condition requiring corrective action. The only defects noted were minor impact damage, and a minor degree of fastener hole fraying and elongation. These are for the most part comparable to damage noted on fiberglass fairings. R.C.T.

N80-23372# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
FATIGUE CHARACTERIZATION OF COMPOSITE MATERIALS Final Report, 1 Oct. 1978 - 15 Apr. 1979
James M. Whitney Oct. 1979 38 p refs
(AF Proj. 2419)
(AD-A081320; AFML-TR-79-4111) Avail: NTIS HC A03/MF A01 CSCL 11/4

A procedure is outlined which allows the generation of an S-N curve with some statistical value without resorting to an extremely large data base. The procedure is based on a power law representation of the S-N curve and a two-parameter Weibull Distribution for time-to-failure at a specific stress level. A data pooling scheme is also discussed which allows the determination of a fatigue shape parameter which is independent of stress level. GRA

N80-23373# Northrop Corp., Hawthorne, Calif. Aircraft Group.
ROOM TEMPERATURE CURING RESIN SYSTEMS FOR GRAPHITE/EPOXY COMPOSITE REPAIR Final Report, Jan. - Dec. 1979
D. J. Crabtree Dec. 1979 83 p
(Contract N62269-79-C-0224)
(AD-A081738; NOR-80-46; NADC-78101-60) Avail: NTIS HC A05/MF A01 CSCL 11/4

Adhesive formulations were developed for the repair of damaged graphite/epoxy structures on board ship. These adhesives cure at 24 C (75 F) or in the moderate temperature range of 67 to 121 C (150 to 250 F). The formulations which gave the best results in lap shear testing were formulated from high molecular weight and high functionality epoxy resins and a polyamine curing agent. A typical formulation is composed of a cresol novalac epoxy, (Ciba-Geigy ECN 1299), the triglycidyl ether of p-aminophenol, (Ciba-Geigy 0510), and diethylenetriamine, a polyamine curing agent. After a 72 hour cure at 24 C (75 F) an adhesive compounded from this formulation had much higher lap shear strength at 121 C (250 F) than did commercially available epoxy, acrylic, and anaerobic adhesives. Aluminum/aluminum bonds tested in a rapid heat-up to 121 C (250 F) (at 150 F/min) and immediate application of load at 121 C (250 F) had lap shear strength of 1400 psi whereas the commercial adhesives had 500-700 psi strength in the same test. The formulation when cured at 121 C (250 F) had lap shear strength at 121 C (250 F) of 2700 psi. Another promising system is the vinyl ester resin system as a moderate temperature, 66 C to 121 C (150 F to 250 F), curing adhesive. It has good environmental durability and methodological research. GRA

N80-23374# Effects Technology, Inc., Santa Barbara, Calif.
RESPONSE OF INFRARED-TRANSPARENT MATERIALS TO RAINDROP IMPACTS Final Report, Aug. 1978 - Aug. 1979
William F. Adler, John C. Botke, and Timothy W. James Wright-Patterson AFB, Ohio AFML Oct. 1979 175 p refs
(Contract F33615-78-C-5143; AF Proj. 2423)
(AD-A081542; ETI-CR79-60; AFML-TR-79-4151) Avail: NTIS HC A08/MF A01 CSCL 13/8

This investigation concentrates on the damage produced in chemically vapor deposited (CVD) zinc sulfide (ZnS) by water drop impacts on the order of 1 mm in diameter impinging over a velocity range from 222 to 684/ms (730 to 2240 fps). A combined experimental and analytical approach was pursued to determine the relationships between water drop impact damage and the material properties of CVD ZnS in order to evaluate and guide efforts to develop erosion resistant window materials for use at 8-12 micrometer wavelengths. Microscopic observations of the damage produced in three formulations of CVD ZnS representing variations in grain size, grain shape, and inclusion content indicated the fracture trajectories and penetration depths were essentially insensitive to the range of microstructural features which were investigated. The quality of the surface finish was found to be the dominant contribution to the fracture response of CVD ZnS. Further modification of the bulk material properties does not appear warranted; the present production material is satisfactory. Considerably greater latitude for increased resistance to rain erosion can be gained from improved polishing procedures and subsequent maintenance of the initial surface finish. GRA

N80-23375# AiResearch Mfg. Co., Torrance, Calif. Materials Engineering Group.
HIGH-TEMPERATURE MECHANICAL PROPERTIES OF SINTERED ALPHA SILICON CARBIDE (13 OCTOBER 1978 - 13 OCTOBER 1979)
David M. Kotchick 19 Feb. 1980 94 p refs
(Contract N00014-76-C-0249)
(AD-A081824; AiResearch-80-16772) Avail: NTIS HC A05/MF A01 CSCL 07/1

Failures on tensile-stressed, as-fired samples were caused primarily by processing defects and did not appear to be associated with compositional changes (amount of sintering agent) in the material. At high testing temperatures (above 1340 C), the occurrence of processing defects appears to control strength, making it impossible to speculate on the effect of salt and oxidation during slow crack growth in these specimens. Over the variety of conditions tested such as salt, oxidation, and their combinations, strength did not vary greatly. Therefore, the defects from processing represents the reasonable lower limit of strength under the imposed testing conditions. The determined strength values probably represent reasonable design data for components with as-fired, as-formed surfaces of similarly processed SASC. Since these strength values represent a reasonable lower limit for as-fired, as-formed surfaces of SASC, the potential is good for improvement by processing improvements to eliminate defects. SASC continues to show promise as a viable engineering material. It will become more attractive for heat exchanger applications in aggressive environments as processing becomes more sophisticated. GRA

N80-23376# Materials Sciences Corp., Blue Bell, Pa.
DEFINITION AND MODELING OF CRITICAL FLAWS IN GRAPHITE FIBER REINFORCED RESIN MATRIX COMPOSITE MATERIALS Final Report, 28 Jul. 1978 - 28 Aug. 1979
S. N. Chatterjee, Z. Hashin, and R. B. Pipes 28 Aug. 1979 121 p refs
(Contract N62269-78-C-0111)
(AD-A080893; MSC/TFR/1105/1008) Avail: NTIS HC A06/MF A01 CSCL 11/4

An analytical and experimental study was conducted to determine criticality of interlaminar disbonds by NDE methods. Criticality of such flaws in a shear environment (action of shear near support) was defined in terms of crack propagation and was analyzed by principles and methods of fracture mechanics. Growth of disbonds under cylic loading was also studied. Failure under compressive loading in presence of a disbond was defined in terms of buckling and an elastic stability analysis was utilized for assessing criticality. Analytical predictions were compared with experimental results in both cases. Utrasonic 'C' scans were used for detection and tracking of the flaws. Preliminary wave propagation studies were conducted for estimating changes in storage and loss moduli induced by moisture conditioning to examine the possibility of using such measurements as NDT techniques for damage assessment. GRA

N80-23377# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.
RAPID PROPAGATION OF INTERFACE-FLAWS IN COMPOSITE BODIES Final Report, 1975 - 1979
J. D. Achenbach Nov. 1979 9 p refs
(Grants DAHC04-75-G-0200; DAAG29-78-G-0031)
(AD-A078813; NU-SML-TR-79-9; ARO-12791.7-E) Avail: NTIS HC A02/MF A01 CSCL 11/4

A summary and a bibliography are presented of the investigations on the rapid propagation of interface flaws in composite bodies, which were carried out at Northwestern University under the sponsorship of the U.S. Army Research Office during the period July 1, 1975 - September 30, 1979. GRA

N80-23378# New York Univ., N. Y.
EFFECTIVE BEHAVIOR OF COMPOSITE MATERIALS Final Technical Report, 1 Aug. 1978 - 31 Jul. 1979
George C. Papanicolaou Jul. 1979 8 p
(Grant AF-AFOSR-3668-78; AF Proj. 2304)
(AD-A078466; AFOSR-79-1157TR) Avail: NTIS HC A02/MF A01 CSCL 11/4

The following four problems have been analyzed in detail. First, the effective heat removal rate for a conducting material perforated with many small holes is computed. Second, for a conducting material impregnated with nonconductors occupying a large fraction of the medium and randomly dispersed the effective conductivity is obtained. Third, for a material with a random rough boundary, a theory of effective boundary impedance has been developed. Fourth, the effects of random structural imperfections on buckling loads of beams have been computed. GRA

N80-23379# United Technologies Research Center, East Hartford, Conn.
PROGRAM TO STUDY SIC FIBER REINFORCED GLASS MATRIX COMPOSITES Annual Report, Jul. 1978 - Jul. 1979
J. J. Brennan Aug. 1979 36 p refs
(Contract N00014-78-C-0503; NR Proj. 032-589)
(AD-A077638; UTRC/R79-914401-2) Avail: NTIS HC A03/MF A01 CSCL 11/4

Glass-ceramic composites reinforced with SiC fibers have been fabricated that exhibit good strength properties from RT to 1000 C. In particular, a lithium-aluminum-silicate (LAS) matrix reinforced with SiC yarn has been shown to possess bend strengths of over 690 MPa (100 ksi) from RT to 800 C. However, the TiO2 nucleating agent present in the usual LAS materials can cause matrix crystallization during hot-pressing and fiber-matrix interactions, making the fabrication of consistently high strength composites extremely difficult. The substitution of ZrO2 for the TiO2 appears to have eliminated this problem. Composites fabricated from SiC monofilament with a magnesium-aluminum-silicate (MAS) matrix have also exhibited high strengths from RT to 1000 C. Again, however, consistent fabrication of reproducibly high strength composites has been difficult due to lack of wetting and bonding between the SiC fibers and the matrix. GRA

N80-23380# General Dynamics Corp., San Diego, Calif. Convair Div.
APPLICATION OF GRAPHITE/EPOXY COMPOSITES FOR THE SPS-10 RADAR REFLECTOR Final Report, Jan. 1978 - Oct. 1979
Gary A. Tremblay Oct. 1979 82 p
(Contract N00024-78-C-5332; SF12141404)
(AD-A077530; GDC-SPS-79-001) Avail: NTIS HC A05/MF A01 CSCL 11/4

The General Dynamics Convair Division was contracted to evaluate the applicability of graphite/epoxy on the SPS-10 reflector. This task was a result of the Navy's study to reduce life cycle costs, acquisition costs, and structural weight of Naval antenna systems. The Convair effort began with a study of the RF performance of a graphite/epoxy grating panel, which proved to perform as well as its metal counterpart. We designed, fabricated, and tested a composite prototype unit of the reflector unit for performance approval. The graphite/epoxy reflector was mounted on a Navy-furnished SPS-10 spider and pedestal for structural (wind and vibration) and RF pattern range testing. All performance test results met or exceeded Navy specifications. Following testing at General Dynamics, the antenna was sent to the Naval Ocean Systems Center (NOSC), San Diego, California, for extended RF and environmental testing prior to shipboard evaluation. The Convair prototype SPS-10 reflector weighs 66.9 pounds (a 14% weight reduction compared to the metal SPS-10). An applications evaluation study during the program showed that a significantly greater weight savings, i.e., a 20.1-pound weight reduction for a 26% weight savings, and reduced fabrication costs could be realized for a production design of the SPS-10 reflector. GRA

N80-23381# Fiat Research Center, Orbassano (Italy).
FABRICATION AND PROPERTIES OF A PRESSURELESS SINTERED SILICON NITRIDE BASED ON Y2O3 AS SINTERING AID
A. Giachello, P. C. Martinengo, G. Tommasini, and P. Popper (British Ceram. Res. Assoc.) 1979 17 p refs Submitted for publication
Avail: NTIS HC A02/MF A01

A powder mixture 91% Si3N4 + 8% Y2O3 + 1% MgO was sintered at 1800 C in nitrogen at atmospheric pressure to a density of 3.25 Mg/cu m. The strength at room temperature was 585 MPa and at 950 C it was 560 MPa. Devitrification of an amorphous phase increased the strength at 1125 C by 44%. The linear shrinkage during sintering was 16%; thus it should be possible to fabricate complex shapes to high dimensional accuracy. The proposed sintering process overcame some of the disadvantages of the reaction-sintering and hot pressing processes. Various mechanical and thermal properties were determined. Author (ESA)

N80-23382# Fiat Research Center, Orbassano (Italy).
SINTERING OF SILICON NITRIDE IN A POWDER BED
A. Giachello, P. C. Martinengo, G. Tommasini, and P. Popper (British Ceram. Res. Assoc.) 1979 8 p refs Submitted for publication
Avail: NTIS HC A02/MF A01

Silicon nitride with the addition of MgO as a sintering aid can be sintered at atmospheric pressure by embedding the powder compacts in a loose powder mixture. By choosing a suitable composition of the powder in the bed, it is possible to control both the decomposition of the silicon nitride and the loss by volatilization of the MgO. In this way one can obtain homogeneously sintered articles of complex shapes of density greater than 3.0 Megagrams per cu m. Author (ESA)

N80-24251 Idaho Univ., Moscow.
DYNAMIC MECHANICAL PROPERTIES OF FIBER-REINFORCED COMPOSITE MATERIALS
R. F. Gibson and D. G. Wilson *In* the Shock and Vibration

Inform. Center, The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 3-12 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics*.

N80-23383* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CHELATE-MODIFIED POLYMERS FOR ATMOSPHERIC GAS CHROMATOGRAPHY Patent
Warren W. Christensen (San Jose State Univ.), Ludwig A. Mayer (San Jose State Univ.), and Fritz H. Woeller, inventors (to NASA) (San Jose State Univ.) Issued 22 Apr. 1980 9 p Filed 30 Jun. 1978 Supersedes N78-27275 (16 - 18, p 2375) Sponsored by NASA
(NASA-Case-ARC-11154-1; US-Patent-4,198,792; US-Patent-Appl-SN-921626; US-Patent-Class-521-55; US-Patent-Class-55-66; US-Patent-Class-55-67; US-Patent-Class-55-68; US-Patent-Class-55-72; US-Patent-Class-521-146; US-Patent-Class-521-918; US-Patent-Class-525-4) Avail: US Patent and Trademark Office CSCL 07D

Chromatographic materials were developed to serve as the stationary phase of columns used in the separation of atmospheric gases. These materials consist of a crosslinked porous polymer matrix, e.g., a divinylbenzene polymer, into which has been embedded an inorganic complexed ion such as N,N'-ethylene-bis-(acetylacetoniminato)-cobalt (2). Organic nitrogenous bases, such as pyridine, may be incorporated into the chelate polymer complexes to increase their chromatographic utility. With such materials, the process of gas chromatography is greatly simplified, especially in terms of time and quantity of material needed for a gas separation.

Official Gazette of the U.S. Patent and Trademark Office

N80-23384 Yale Univ., New Haven, Conn.
DEVELOPMENT OF DYNAMIC NMR PULSE TECHNIQUES AND APPLICATIONS TO MEMBRANE PERMEATION AND PEPTIDE BOND ROTATION KINETICS Ph.D. Thesis
Jeffry Roy Alger 1979 311 p
Avail: Univ. Microfilms Order No. 8011521

Nuclear magnetic resonance (NMR) techniques were developed for the measurement of phospholipid membrane permeation by small molecules. A magnetization transfer NMR pulse technique termed selective population transfer (SPT) was developed for this purpose. Membrane permeation was studied when the NMR signal arising from a solute entrapped within a limiting membrane was resolved from the signal arising from excluded solute permeation exchanges entrapped and excluded solute and introduced exchange effects into the NMR spectrum. When the permeation rate was similar to the nuclear relaxation rate, permeation was measured with SPT. Faster permeation rates were measured with classical techniques involving lineshape analysis. The longitudinal relaxation of the exchanging nuclear resonances was observed after one resonance was selectively inverted. Iterative nonlinear least squares curve fitting of the observed relaxation to the theoretical relaxation curves was employed to determine the exchange rates. Initially the SPT technique was tested by measuring the interconversion rate between the cis and trans peptide bond conformations for the dipeptide, glycylsarcosine. Dissert. Abstr.

N80-23385 Wisconsin Univ. - Milwaukee.
A STUDY OF THE HYDROGEN ASSOCIATED WITH SUPPORTED AND UNSUPPORTED MOLYBDENUM OXIDE. 1: MOLYBDENA-ALUMINA CATALYSTS. 2: HYDROGEN MOLYBDENUM BRONZES Ph.D. Thesis
Alexander Carl Cirillo, Jr. 1979 268 p
Avail: Univ. Microfilms Order No. 8009232

Nuclear magnetic resonance (NMR) techniques were used to investigate the dehydroxylation of alumina and molybdena-alumina catalysts. The decrease in the percentage of hydroxyls observed by NMR with increasing temperature of dehydroxylation suggested a strong interaction between the unobservable hydroxyls, shown to be present by D2 exchange, and the Al(+3) ions exposed on the surface. The hydroxyls were restored to detection by NMR upon adsorption of D2O. The hydrogen spillover technique was used to form hydrogen molybdenum bronzes at 60 C by exposing platinized MoO3 to H2. Attempts to form lower bronzes, viz. H0.5MoO3, resulted in heterogeneous samples. The NMR lineshape observed at room temperature exhibited a total anisotropy of ~23 ppm and was postulated to result from the extensive proton mobility in the irregularly shaped particles of the conducting oxide. Below 200 K, the proton mobility deceased and the homonuclear dipolar interaction became important; the lineshape became Lorentzian suggesting residual rotational motion. Dissert. Abstr.

N80-23386 Texas Univ. at Austin.
AN ELECTRON SPECTROSCOPIC INVESTIGATION OF THE INTERACTION OF METHANOL AND AMMONIA WITH CLEAN AND PARTIALLY OXIDIZED ALUMINUM SURFACES Ph.D. Thesis
James William Rogers, Jr. 1979 281 p
Avail: Univ. Microfilms Order No. 8009920

The oxidation of clean polycrystalline Al and the interaction of CH3OH and NH3 with clean and oxidized Al surfaces were studied using both ultraviolet and X-ray photoelectron spectroscopy as well as X-ray excited Auger electron spectroscopy. Ultrahigh vacuum conditions in the temperature range 106-673 K were used. Low exposure of O2 at 128 K caused dissociation and subsequent incorporation of oxygen below the surface leaving a depletion layer rich in Al(delta +). Sorption at intermediate exposures led to the formation of amorphous Al2O3 islands while high exposures formed a thin layer of amorphous Al2O3 which covered the entire surface. The D2O initially dissociated and oxidized clean Al at 128 K followed by condensation at higher exposures. An increase in surface temperature led to the desorption of the condensed multilayer beginning near 180 K, leaving the surface partially hydroxylated at 200-270 K. Further increases in temperature converted the hydroxide to surface oxide (Al2O3) as did D2O adsorption at 300 K. Dissert. Abstr.

N80-23387 Ohio Univ., Athens.
THE IDENTIFICATION OF CHROMATOGRAPHICALLY SEPARATED FRACTIONS BY FOURIER TRANSFORM INFRARED SPECTROSCOPY Ph.D. Thesis
Donald Kuehl 1979 184 p
Avail: Univ. Microfilms Order No. 8010855

Improvements in the sensitivity and versatility of both a gas chromatography-Fourier transform infrared (GC/FT-IR) interface and a high performance liquid chromatography-Fourier transform infrared spectroscopy (HPLC/FT-IR) interface to aid in the identification of chromatographically separated fractions are described. The sensitivity of the FT-IR spectrometer was improved by using a dual beam optical subtraction technique which decreased the signal-to-noise ratio of the interferogram about zero retardation. This allowed a more sensitive mercury cadmium detector to be substituted for the conventional triglycine sulfate detector. This system was applied to support coated open tubular column GC/FT-IR measurements using a lightpipe which was optimum for these columns. This system was used to measure spectra of low nanogram quantities of sample, separated by SCOT columns. To lower the detection for compounds separated by HPLC below the microgram range, a microprocessor controlled HPLC/FT-IR interface was designed and constructed which used a diffuse reflectance sampling technique and automated solvent elimination. Dissert. Abstr.

N80-23388 Utah Univ., Salt Lake City.
NUMERICAL STUDIES OF PHYSICAL VAPOR TRANSPORT Ph.D. Thesis
David William Greenwell 1980 199 p

Avail: Univ. Microfilms Order No. 8011589

The viscous and gravitational influences on the mass transport formulations for vapor are studied. The treatment is limited to binary physical vapor transport in vertical right circular cylinders. Numerical solutions were obtained for the coupled mass momentum, and chemical species (diffusion) transport equations. Since gravitational influences were of interest, calculations were made with the assumption that the two components differed in molecular weight. The relation between the Reynolds number and the aspect ratio is discussed and the effect of the convective component of mass flow on the concentration gradients is described. Dissert. Abstr.

N80-23389 Pennsylvania State Univ., University Park.
THEORETICAL AND EXPERIMENTAL STUDIES ON THE DIELECTRIC AND OPTICAL PROPERTIES OF FLUIDS UNDER HIGH PRESSURE Ph.D. Thesis
Chung Chih Chen 1979 231 p
Avail: Univ. Microfilms Order No. 8010037

The variation of the refractive index of liquid with pressure to 14 kbar was determined by an optical interferometric method. The liquids studied were chloroform, carbon disulfide, o-xylene, n-xylene, 1-3-5 trimethyl benzene, cumene, methyl cyclohexane, ethyl bromide, ethyl iodide, i-butyl alcohol, ethyl alcohol, and deuterium oxide at room temperature. Since some of these liquids freeze at room temperature even before 14 kbar is reached, the measurements were carried out up to the freezing point or 14 kbar, whichever pressure is lower. In every case the refractive index increased with pressure with pronounced nonlinearity, particularly at high pressure. This nonlinearity was reduced considerably when the same data on delta n were considered as a function of the volume strain indicating that the nonlinear piezo-optic behavior of liquids was just a manifestation of nonlinear P-V relationship. Further, it is found that the slight nonlinearity noticed in the delta N-delta V/V sub o relationship could be still further reduced when the variation in refractive index is treated as a function of the Lagrangian and Eulerian strains. Other significant results are reported. Dissert. Abstr.

N80-23390 Iowa State Univ. of Science and Technology, Ames.
OXYGEN REDUCTION OF A GRAPHITE PASTE AND A CATALYST LOADED GRAPHITE PASTE ELECTRODE Ph.D. Thesis
Dennis Michael DiMarco 1979 164 p
Avail: Univ. Microfilms Order No. 8010226

Oxygen reduction was studied in basic solution at graphite paste electrode (GPE). The GPE was used as the disk of a rotating ring disk electrode (RRDE) and experiments were done using the voltage scan technique. The enhancements afforded by catalysts applied to the GPE were also studied. Oxygen reduction on a GPE was shown to be a two electron process resulting in the formation of peroxide. The Tafel slope was 180 mV. The presence of gold, silver, or platinum on the GPE shifted the oxygen reduction wave approximately 800 mV in the anodic direction. Comparison of the data on a metal catalyzed GPE to the solid metal electrode showed that the former electrode produced a greater fraction of peroxide as product than did the latter. Silver and gold catalyzed GPEs gave Tagel slopes of about 120 mV. The intermediate catalysis of iron and cobalt porphyrin was also examined. While the cobalt porphyrin catalyzed oxygen reduction at a more anodic potential than the iron porphyrin, the latter appeared more active in reacting the peroxide formed as the product of the disk reaction. Dissert. Abstr.

N80-23391 Georgia Inst. of Tech., Atlanta.
IMPROVEMENTS IN DETECTION CAPABILITIES IN ATOMIC SPECTROSCOPY Ph.D. Thesis
John William Novak, Jr. 1979 175 p
Avail: Univ. Microfilms Order No. 8010004

High powered pulsed, ratio frequency (RF) - excited, electrodeless discharge lamps (EDLs) were characterized as possible sources for atomic spectroscopy. Novel behavior of the lamps was observed when they were operated in a pulsed mode. The radiant output of the EDLs was found to increase rapidly when short pulses were used, at incident powers where continuous wave (CW) operation of the lamps often resulted in decreased radiant output, thus indicating different excitation processes in the two modes of operation. The behavior of RF-excited Ar, Hg, Cd and Zn EDLs were compared with microwave excited lamps for the same elements. The process of liquid sample introduction into flames and plasmas was evaluated. An aerosol monitoring system was developed capable of measuring size distributions of spray droplets produced from common nebulizers used for analytical atomic spectrometry. The system provided a means for the systematic characterization of droplet sizes of the various sprays in the diameter range 0.10 to 10 micrometers. Droplet distributions were obtained using a cascade impactor operated in series with an electrical aerosol analyzer. Results are presented. Dissert. Abstr.

N80-23392 American Univ., Washington, D. C.
ELECTRO-OXIDATION OF HYDROGEN AND PROPANE IN STRONG ORGANIC ACID ELECTROLYTES Ph.D. Thesis
Jalil Ahmad 1980 128 p
Avail: Univ. Microfilms Order No. 8010687

The electrochemical behavior of methane sulfonic acid, ethane sulfonic acid, and sulfoacetic acid as fuel cell electrolytes was studied in a half cell at various temperatures. The methane sulfonic acid and ethane sulfonic acid have shown no promise with propane and therefore cannot be used as potential electrolytes for the hydrocarbon-air fuel cell. Adsorption on the platinum electrode surface and decomposition during electrolysis of these acids was also observed. Sulfoacetic acid with H2 supported about two times higher current density than trifluoromethane sulfonic acid monohydrate. It is concluded that the sulfonic acids containing unprotected C-H bonds are strongly adsorbed on the platinum surface and decompose easily during the electrolysis; thus, a preferred electrolyte should be substituted sulfonic acid. Dissert. Abstr.

N80-23393*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RATE CONSTANT FOR THE REACTION OF HYDROXYL RADICAL WITH FORMALDEHYDE OVER THE TEMPERATURE RANGE 228-362 K
L. J. Stief, D. F. Nava, W. A. Payne, and J. V. Michael Mar. 1980 17 p refs
(NASA-TM-80666) Avail: NTIS HC A02/MF A01 CSCL 07D

Absolute rate constants for the reaction OH + H2CO measured over the temperature range 228-362 K using the flash photolysis-resonance fluorescence technique are given. The results are independent of variations in H2CO concentration total pressure Ar concentration, and flash intensity (i.e., initial OH concentration. The rate constant is found to be invariant with temperature in this range, the best representation being k sub 1 = (1.05 + or - 0.11) x 10 to the 11th power cc molecule (-1) s (-1) where the error is two standard deviations. This result is compared with previous absolute and relative determinations of k sub 1. The reaction is also discussed from a theoretical point of view. M.G.

N80-23394*# National Aeronautics and Space Administration. Pasadena Office, Calif.
POTENTIAL HEAT EXCHANGE FLUIDS FOR USE IN SULFURIC ACID VAPORIZERS Patent Application
D. D. Lawson (JPL) and G. R. Petersen, inventors (to NASA) (JPL) Filed 30 Apr. 1980 17 p
(Contract NAS7-100)
(NASA-Case-NPO-15015-1; US-Patent-Appl-SN-145207) Avail: NTIS HC A02/MF A01 CSCL 07A

The testing of several candidate perfluorocarbon liquids for the direct fluid contact heat exchange with H2SO4 at about 330 C prior to high temperature decomposition in the oxygen release step of several thermochemical cycles for splitting water into hydrogen and oxygen is described. Among the several liquids tested, only perfluoropropylene oxide polymers having a degree of polymerization from about 10 to 60 were chemically stable and had low miscibility and vapor pressure when tested with sulfuric acid at temperatures from 300 C to 400 C. The thermochemical cycle is outlined. NASA

N80-23395# Extranuclear Labs., Pittsburgh, Pa.
METAL ION REACTIONS WITH OZONE AND ATOMIC OXYGEN Final Report, 1 Sep. 1977 - 31 Dec. 1978
W. L. Fite, M. W. Siegel, and H. H. Lo Hanscom AFB, Mass.

AFGL Apr. 1979 71 p refs
(Contract F19628-77-C-0236; DNA Proj. S99-QAXHD411)
(AD-A081516; AFGL-TR-79-0092) Avail: NTIS HC A04/MF A01 CSCL 11/6

An experiment attempting to measure the thermal and near-thermal rate coefficients for reactions of metal ions with O and O3 is summarized. The method involves a new type of drift tube made of a fully oxidized leaky dielectric material (Cerramag C-11) which permits placing of the drift field without metallic electrodes which could degrade O and O3 into O2 in surface reactions. In the experiments Al(-) from an external surface ionization source was used, the drift gas was argon to which the reactant gas was added, and ions emerging from the drift tube were mass spectrometically detected. It was found by modulated beam mass spectrometry that ozone was not degraded in the drift tube; the atom content in partially dissociated oxygen admitted to the tube was too low to get unequivocal data on the integrity of O in the tube. GRA

N80-23396# Pennsylvania Univ., Philadelphia. Dept. of Physics.
RAMAN SPECTROSCOPY OF SOLIDS Final Report, 19 Jun. 1974 - 30 Sep. 1979
Elias Burstein Feb. 1980 11 p refs
(Grants DAHC04-74-G-0181; DAAG29-76-G-0325)
(AD-A081517; ARO-11716.6-P; ARO-14332.7-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

Research on the inelastic scattering of light by elementary excitations in solids has provided information about the nature of the excitations, the relevant microscopic light scattering mechanisms and the electronic energy band structure of the solids. Results of work on the following problems are summarized: (1) resonance Raman scattering as a probe of space charge fields at semiconductor surfaces; (2) Raman scattering and light diffraction by surface poloritons; (3) surface-electromagnetic wave enhancement of Raman scattering and nonlinear optical phenomena; (4) giant Raman scattering molecules adsorbed metal surfaces; and (5) inelastic light scattering by charge carriers in two dimensionzl plasmas. GRA

N80-23397# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
CHARACTERIZATION OF PASSIVE FILMS USING INFRARED AND RAMAN SPECTROSCOPY Final Report
J. Keiser, P. Fabis, C. Brown, and R. Heidersbach Jan. 1980 104 p refs
(Contract N00014-76-C-0889)
(AD-A081240; TR-8) Avail: NTIS HC A06/MF A01 CSCL 07/4

This report summarizes current research into the application of infrared and Raman spectroscopy to the study of passive films on metals. One section of the report discusses the results of computer interfacing of the Raman spectrometer with a minicomputer to produce signal averaged spectra. The signal-averaged Raman spectra reveal spectral details undistinguishable in a single spectrum. A parallel study involved exposure of iron, chromium, and two commercial iron-chromium alloys. GRA

N80-23398# Yale Univ., New Haven, Conn. School of Medicine.
METHODS FOR THE ISOLATION AND IDENTIFICATION OF POLYCYCLIC AROMATIC HYDROCARBONS FOUND IN COMPLEX MIXTURES AND THEIR POSSIBLE TOXICITY BY MEANS OF BIOASSAY TECHNIQUES Progress Report, 1 Aug. 1978 - Aug. 1979
S. R. Lipsky and W. J. McMurray Aug. 1979 24 p refs
(Contract EY-76-S-02-2958)
Avail: NTIS HC A02/MF A01

A computer controlled gas chromatography mass spectrometer is described. Materials under consideration include shale oil extracts, their dimethyl sulfoxide extracts and product waters. A chart of individual identified polycyclic aromatic hydrocarbons is given. DOE

N80-23399# California Univ., Berkeley. Lawrence Berkeley Lab. National Geothermal Information Resource.
AQUEOUS SOLUTIONS DATABASE TO HIGH TEMPERATURES AND PRESSURES: NaCl SOLUTIONS
S. L. Phillips, Roland J. Otto, Huseyin Ozbek, and Mehdi Tavana Aug. 1979 30 p refs Presented at the Workshop on Tech. for Meas. of Thermodyn. Properties, Albany, Oreg. 21-23 Aug. 1979
(Contract W-7405-eng-48)
(LBL-9621; CONF-790896-1) Avail: NTIS HC A03/MF A01

Available experimental data on sodium chloride solutions which are used in geothermal energy exploration and development for electrical power production and direct use were surveyed. The data are classified as thermodynamic, transport and physical; they are useful in the design and development of a geothermal area from brine production through utilization, to brine disposal. An ideal data system for geothermal energy is described. DOE

N80-23400# Oak Ridge National Lab., Tenn.
MASS TRANSPORT IN MOLTEN-SALT ELECTROCHEMICAL SYSTEMS
J. U. Niwalor and A. R. Manner 24 Mar. 1979 25 p refs
(Contract W-7405-eng-26)
(ORNL/MIT-290) Avail: NTIS HC A02/MF A01

Early time behavior of the open cell potential of a Li2CO3/K2CO3 electrolysis system was investigated to identify the various regimes involved. The regimes that were identified include the IR drop, anodic and cathodic double layer decays, and the thermoelectric effects. The presence of a gaseous diffusion process was also inferred. DOE

N80-23401# Sandia Labs., Livermore, Calif. Applied Physics Div.
COHERENT RAMAN COMBUSTION DIAGNOSTICS
P. L. Mattern and L. A. Rahn 1980 19 p refs Presented at the 179th Natl. Meeting of the Am. Chem. Soc., Houston, Tex., 23 Mar. 1980
(Contract EY-76-C-04-0789)
(SAND-79-8807; CONF-800303-2) Avail: NTIS HC A02/MF A01

The use of background free coherent anti-Stokes Raman scattering and inverse Raman scattering to detect small concentrations of CO in a methane-air flame is discussed. Calculated detectivities for these techniques, as compared with spontaneous Raman scattering, for a broad range of temperature, pressure, and background luminosities are presented. DOE

N80-23402# Massachusetts Univ., Amherst. Dept. of Chemistry.
ANALYTICAL CHEMICAL SYSTEM FOR THE DETERMINATION OF HEAVY METALS AND ORGANIC COMPOUNDS Annual Progress Report, 1 Dec. 1978 - 30 Nov. 1979
Sidney Siggia and Ramon M. Barnes 24 Oct. 1979 49 p refs
(Contract EE-77-S-02-4320)
(COO-4320-2) Avail: NTIS HC A03/MF A01

Progress was made in the synthesis and characterization of resins for sequestering inorganic and organic compounds. The capabilities of the poly(dithiocarbamate) resin were extended, a poly(acrylamidoxime) resin prepared and characterized, and a series of resins for organic compounds prepared and tested. Limited actual sample analyses were performed with these resins. An inductively coupled plasma source, spectrometer and computer system were received and tested. DOE

N80-23403# California Univ., Berkeley. Lawrence Berkeley Lab.
MICROWAVE SPECTROMETER FOR THE DETECTION OF TRANSIENT GASEOUS SPECIES
W. F. Kolbe, Wolf-Dieter Zoellner, and B. Leskovar 1 Jun. 1979 30 p refs
(Contract W-7405-eng-48)
(LBL-7293) Avail: NTIS HC A03/MF A01

A microwave spectrometer and the associated apparatus used to detect unstable free radical species is described. The spectrometer, which operates over a frequency range from 66 to 73 GHz consists of a tunable Fabry-Perot resonator followed by superhetrodyne detection for high sensitivity at low power levels. The resonator tuning is accomplished by means of a computer controlled stepping motor and by a piezoelectric transducer which also permits the use of source modulation and phase sensitive detection at 100 Hz. The operations of the spectrometer is

demonstrated by the detection of the two free radical species OH and SO. In the case of OH, a number of lambda doubling transitions, previously unobserved, are reported. DOE

N80-23404# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
COHERENT ANTI-STOKES RAMAN SCATTERING AT ELECTRONIC RESONANCE: APPLICATION TO IODINE Thesis - Paris-Sud Univ.
Brigitte Attal 1979 91 p refs IN FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-608) (ONERA-NT-1979-4) Avail: NTIS HC A05/MF A01

The main properties and application of Coherent Anti-Stokes Raman scattering (CARS) are first detailed and the advantages of resonant excitation pointed out. In particular, the intensities of the Raman lines must be enhanced by several orders of magnitude. Specificity is thus improved and detection of trace pollutants in mixtures becomes possible. Results of experiments with NO2 and I2 are presented, and a study of iodine (partial pressure of 1 mb) in air in normal conditions is made. Two spectra were plotted for two distinct values of the laser frequency omega L in the proximity of the B-X transition absorption lines. Enhancement of the intensities of the CARS lines by one photon resonance is experimentally confirmed in iodine. Author (ESA)

N80-23405# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXAMINATION OF THE REACTIONS OF O+ WITH CH4, C2H4, C2H6, C3H8 AND N+ WITH CO BY MEASUREMENT OF THE LUMINESCENCE AND THE TRANSLATIONAL ENERGY OF THE PRODUCT IONS Thesis - Georg-August Univ. [UNTERSUCHUNG DER REAKTIONEN VON O+ MIT CH4, C2H4, C2H6, C3H8 UND N+ MIT CO DURCH MESSUNG DER LUMINESZENZ UND DER TRANSLATIONSENERGIE DER PRODUKT-IONEN]
Stefan Zimmermann Jun. 1979 143 p refs In GERMAN (MPIS-9/1979) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 24

Luminescent atom exchange reactions of O+ ions with hydrogen and different hydrocarbons are examined. The optical and translational spectra of the N+ - CO system are presented. Author (ESA)

N80-23406# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
APPLICATION OF LASER-INDUCED FLUORESCENCE FOR MEASURING REACTION RATE CONSTANTS IN H-N-C-O SYSTEMS [ANWENDUNG VON LASERINDUZIERTER FLUORESZENZ ZUR MESSUNG VON REAKTIONSGESCHWINDIGKEITSKONSTANTEN IM H-N-C-O-SYSTEM]
W. Hack, M. R. Schroeter, and H. G. Wagner Jul. 1979 69 p refs In GERMAN (MPIS-13/1979) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 12.60

Reactions of NH2 radicals with nitrogen-oxygen compounds and hydrocarbons were investigated in a flow reactor at temperatures between 203 K and 505 K and pressures between 0.8 mbar and 21 mbar. In some cases, reaction products were detected using mass spectroscopy. NH2 radicals were produced in the reaction F + NH3 yields NH2 + NF and were monitored by laser induced fluorescence. Temperature dependencies at 1.3 mbar were determined for the reactions of NH2 with NO, NO2 and C2H2. The rate constant of the reaction NH2 + C2H4 was independent of temperature within experimental error. Author (ESA)

N80-23407# Rolls-Royce Ltd., Derby (England).
GRAVIMETRIC DETERMINATION OF GAS SORPTION BY MEANS OF AN ELECTRONIC MICRO-BALANCE
G. Sandstede (Battelle Inst.) and E. Robens (Battelle Inst.) 1979 15 p refs Transl. into ENGLISH from Chem.-Ing.-Tech. (West Germany), no. 6, 1960 p 413-417 In ENGLISH and GERMAN (PNR-90009; Trans-14483) Avail: NTIS HC A02/MF A01

A vacuum apparatus for the gravimetric measurement of sorption, in which pressure and quantity of sorbate are determined independently of each other (the quantity of sorbate by weighing), is described. Using a electronic microbalance, the apparatus enables the sorption of gases and vapors at pressures between .000005 Torr and 1 at m to be measured, and the shape of complete sorption isotherms to be recorded with a constant degree of accuracy. The lower limit of the surface of a weighed sorption sample for surface determination by the BET method is approximately 100 sq cm. Measurements were made of the adsorption of nitrogen and krypton on aluminum foil and aluminum powder, as well as on aluminum oxide and glass spheres, in order to compare the results of the BET surface determination with measured geometric surface values, as well as to determine the surface loading of a krypton atom and the pore radius distribution from description isotherms. In addition, the effect of various surface finishes on the shape of the isotherms was investigated for aluminum. Author (ESA)

N80-23408# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdeling Buitenlucht.
THE USE OF INDIGODISODIUMDISULFONATE TO COMBAT MOLDS IN OZONE REAGENTS [DE BESTRIJDING VAN SCHIMMELS IN HET OZONREAGENS OP BASIS VAN INDIGODINATRIUMDISULFONAAT]
L. F. Heidema May 1978 8 p In DUTCH (IG-TNO-G-861) Avail: NTIS HC A02/MF A01

Measures taken to suppress the growth of molds in reagents is described. The influence of NO2 and SO2 on the results are given. Studies were made with sulfanilamide and streptomycin, formaldehyde, tris (hydroxy methyl) aminomethane, and indigodisodiumdisulfonate. Author (ESA)

N80-23409# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Groep Analytische Chemie.
C2-C6 HYDROCARBONS IN AIR: GAS CHROMATOGRAPHIC ANALYSIS OF C2-C6 HYDROCARBONS IN AIR USING A CONCENTRATING TECHNIQUE [C2-C6 KOOLWATERSTOFFEN IN LUCHT. GASCHROMATOGRAFISCHE BEPALING VAN C2-C6 KOOLWATERSTOFFEN IN LUCHT MET BEHULP VAN EEN CONCENTRERINGSTECHNIEK]
E. Burghardt Jul. 1978 13 p ref In DUTCH (IG-TNO-H-393) Avail: NTIS HC A02/MF A01

A concentrating and chemical analysis technique for hydrocarbons in the air is described. The hydrocarbon components are concentrated in a cold trap cooled with liquid nitrogen. After thermic desorption with the aid of a carrying gas, they are transported to the chromatographic column. Concentrations in the sub-ppb region can then be measured. Author (ESA)

N80-23410# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
GC ANALYSIS ALDEHYDES: GAS CHROMATOGRAPHIC ANALYSIS OF C2-C6 ALKANES IN AIR USING AN ISOLATION AND CONCENTRATION METHOD BASED ON BISULPHATE ADDUCTION FORMATION [GC-BEPALING ALDEHYDEN. DE GASCHROMATOGRAFISCHE BEPALING VAN C2-C6 ALKANALEN IN LUCHT MET GEBRUIKMAKING VAN EEN ISOLATIE- EN CONCENTRERINGSMETHODE OP BASIS VAN BISULFIETADDUCTVORMING]
C. vanWaas 29 May 1979 31 p refs In DUTCH (IG-TNO-H-399) Avail: NTIS HC A03/MF A01

A gas chromatography method capable of detecting concentrations of alkanes as low as 1 ppb in air is described. After the collection of alkanes in bisulphite reagents, they are respectively freed, expelled and concentrated on sorbant and desorbed again thermically for gas chromatographic analysis. The process is only efficient if the columm is kept below -15 C. Author (ESA)

N80-23411# European Space Agency, Paris (France).
FORMATION OF PROMPT NITROGEN OXIDES DURING COMBUSTION OF HYDROCARBONS Thesis - Paris VI Univ., 3 Nov. 1978
Nicole Avezard (ONERA, Paris) Feb. 1980 97 p refs Transl. into ENGLISH of "Formation Precoce d'Oxydes d'Azote au Cours de la Combustion d'Hydrocarbures", Rept. ONERA-NT-1978-4 ONERA, Paris Original report in FRENCH previously announced as N79-32314 (ESA-TT-579; ONERA-NT-1978-4) Avail: NTIS HC A05/MF A01

The theoretical schemes determining the early NO concentrations were verified by comparison with experimental results obtained in a stirred combustor. The influence of water vapor on early NO formation, from both the experiment and theoretical viewpoints, is also emphasized. The experimental early NO concentration, obtained in a Longwell type combustor, was determined to be the difference between the experimental NO and the thermal NO calculated using the Zeldovich mechanism, while taking into account an over-equilibrium of O. A process involving HCN is suggested as a explanation of the phenomenon. The Miyauchi model, complemented by the Jachimowski reactions, accounts exactly for the experimental early NO with a residence time on the order of 1 ms; for higher residence times, the calculation is much more complex. Results on the influence of water on nitrogen oxides are presented. Calculations made it possible to determine this effect, which is essentially thermal for lean mixtures; it is more complex for rich mixtures.
Author (ESA)

N80-23412# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
CHEMICAL REACTIONS IN A TURBULENT MEDIUM Thesis - Paris VI Univ.
Roland Borghi 1979 99 p refs In FRENCH; ENGLISH summary
Report will also be announced as translation (ESA-TT-638)
(ONERA-NT-1979-2; ISSN-0078-379X) Avail: NTIS HC A05/MF A01

Different aspects of reactive turbulent flows are discussed including: the turbulent diffusion of possibly reactive species in a medium with variable density, the analysis of fluctuations of species concentrations, and the calculation of the mean reaction rate. Using partial differential equations for the moments of fluctuations together with particular closure assumptions, solutions for these problems are proposed. Two applications are highlighted. The first deals with the development of a high velocity premixed flame in a constant area duct. The second is devoted to the combustion in a fixed volume burner. The influence of such small scale disturbances on the rate of energy release and on the production of pollutant species NOx is discussed.
Author (ESA)

N80-23413# Oxford Univ. (England). Cryogenics Lab.
HEROP: A COMPUTER PROGRAM FOR THE THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES OF HELIUM, THIRD EDITION
B. A. Hands Apr. 1979 69 p refs
(OUEL-1289/79) Avail: NTIS HC A04/MF A01

A set of FORTRAN subprograms called HEPROP used to calculate the thermophysical properties of helium are presented. The thermodynamic properties are derived from the equation of state which is valid from about 2 K to 1700 K, and up to about 100 MPa. By analytical differentiation and integration, pressure (P), enthalpy (h), entropy (s), (delta P/delta T) sub rho, (delta P/delta rho) sub T and C sub v are calculated as a function of density (rho) and temperature (T). Equations are provided for pressure, liquid density and vapor density at saturation. In addition, programs are given for C sub p, h sub fg, s sub fg, the velocity of sound and the Joule-Thomson coefficient. Programs are also devised to calculate T as a function of (rho, P), (P, h), (rho, h), (rho, s) and (P, s); and rho as a function of (P, T) (T, s), (P, h) and (R, s). Subprograms for calculating rho as a function of (P, H), H as a function of (P, S), S as a function of (P, H), and T as a function of (P, H) and for saturation enthalpy are also included. Equations for surface tension, viscosity, refractive index thermal conductivity and dielectric constant are included in HEPROP.
Author (ESA)

N80-23414# Envirogenics Systems Co., El Monte, Calif.
DEVELOPMENT OF A COMPOSITE REVERSE OSMOSIS MEMBRANE FOR SINGLE PASS SEAWATER DESALINATION Final Report
A. F. Graefe Feb. 1979 41 p refs
(Contract DI-14-34-0001-7541)
(PB80-124852; W80-02295; OWRT-7541(1)) Avail: NTIS HC A03/MF A01 CSCL 07D

An improved reverse osmosis composite noncellulosic membrane for the single pass desalination of seawater was developed and its performance in the form of four inch diameter spiral elements was demonstrated. A total of three membranes was investigated.
GRA

N80-23415# Envirogenics Systems Co., El Monte, Calif.
DEVELOPMENT OF LOW PRESSURE BRACKISH WATER REVERSE OSMOSIS MEMBRANES Final Report
A. F. Graefe and W. J. Schell May 1979 42 p refs
(Contract DI-14-34-0001-7510)
(PB80-126204; W80-02296; OWRT-7510(1); Rept-1093-25)
Avail: NTIS HC A03/MF A01 CSCL 07D

Chemically stable noncellulosic desalination membranes were developed with reverse osmosis properties at pressures of 250 psi or less that are equivalent to those of currently available cellulosic membranes operating at 400 psi. Several membranes were investigated. One membrane consisted of a thin layer of sulfonated polyfurfuryl alcohol on a microporous polysulfone as a support (SPFA). This membrane exhibited water flux values up to 50 gfd at 98% salt rejection when tested at 250 psi with 0.5% sodium chloride. Subsequent long term testing of the membrane in element form at 100 to 300 psi showed that it was unstable to simulated Yuma feedwater. Another membrane of interest was asymmetric and was fabricated from a sulfonated polysulfone.
GRA

N80-23416# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.
DETERMINATION AND ESTIMATION OF IONIC ACTIVITIES OF METAL SALTS IN WATER
N. A. Gokcen 1979 29 p refs
(PB80-112212; BM-RI-8372) Avail: NTIS HC A03/MF A01 CSCL 07D

Appropriate equations correlating the activity of water with the activities of electrolytes in binary and multicomponent solutions were derived for computer calculation. It was found that the half-integer power series are far superior to the integer power series, for both types of series having the same number of terms. The proposed method of calculation is capable of accurately yielding the activities of all components from the measurements of the activity of a single component at various concentrations. This method replaces the cumbersome and objectionable method of graphical integration of the Gibbs-Duhem equation.
GRA

N80-23417# Research Triangle Inst., Research Triangle Park, N. C.
COMPUTER PROGRAMS FOR REDUCING MASS SPECTRA DATA FROM GC/MS SYSTEMS Final Report, Sep. 1977 - Mar. 1979
David Rosenthal Oct. 1979 171 p refs
(Contract EPA-68-02-2745)
(PB80-133119; EPA-600/2-79-194) Avail: NTIS HC A08/MF A01 CSCL 07D

Existing computer programs for deconvoluting mass spectrometry data derived from gas chromatography, mass spectrometry, computer systems were evaluated, and the most efficient method was introduced into UNIVAC computer. The accompanying program listing is included. The program was tested with both standard runs and environmental samples. Sample components were sucessfully identified by an independent computer search program with an accuracy approaching 80%.
GRA

N80-23418# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: CHLORINATED HYDROCARBONS MANUFACTURE Final Report, Jan. 1978 - Aug. 1978
Z. S. Khan and T. W. Hughes Aug. 1979 191 p refs
(Contract EPA-68-02-1874)
(PB80-138209; MRC-DA-913; EPA-600/2-79-019-G) Avail: NTIS HC A09/MF A01 CSCL 07A

A study of air pollutants released during the manufacture of chlorinated hydrocarbon is described. The potential environmental effect of the source was evaluated using source severity, S, defined as the ratio of the maximum ground level concentration of a emission to the ambient air quality standard for criteria pollutants or to modified noncriteria pollutants. A representative plant was defined for each manufacturing process type and the environmental effects were determined on the basis of capacity instead of production.
GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N80-23419* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PREPARATION OF MONOTECTIC ALLOYS HAVING A CONTROLLED MICROSTRUCTURE BY DIRECTIONAL SOLIDIFICATION UNDER DOPANT-INDUCED INTERFACE BREAKDOWN Patent
Richard A. Parr, Mary H. Johnston, and John C. McClure, inventors (to NASA) Issued 15 Apr. 1980 8 p Filed 29 Dec. 1978 Supersedes N79-16943 (17 - 08, p 0953)
(NASA-Case-MFS-23816-1; US-Patent-4,198,232; US-Patent-Appl-SN-974292; US-Patent-Class-75-135; US-Patent-Class-75-138; US-Patent-Class-75-178R; US-Patent-Class-148-32) Avail: US Patent and Trademark Office CSCL 11F

Monotectic alloys having aligned spherical particles of rods of the minor component dispersed in a matrix of the major component are prepared by forming a melt containing predetermined amounts of the major and minor components of a chosen monotectic system, providing in the melt a dopant capable of breaking down the liquid solid interface for the chosen alloy, and directionally solidifying the melt at a selected temperature gradient and a selected rate of movement of the liquid-solid interface (growth rate). Shaping of the minor component into spheres or rods and the spacing between them are controlled by the amount of dopant and the temperature gradient and growth rate values. Specific alloy systems include Al Bi, Al Pb and Zn Bi, using a transition element such as iron.
Official Gazette of the U.S. Patent and Trademark Office

N80-23420 Pennsylvania State Univ., University Park.
INVESTIGATIONS INTO THE GRAIN REFINEMENT OF COPPER Ph.D. Thesis
Bruce Lee Tuttle 1979 174 p
Avail: Univ. Microfilms Order No. 8010106

Special melting procedures were established to control the as-melted constitution of copper. A series of criteria were developed to characterize those compounds that would be suitable inoculants for copper. A model was designed to characterize the growth restricting potential of individual element in copper. A thermal analysis testing procedure was developed to instantaneously evaluate the degree of grain refinment in castings. A testing system was also developed utilizing a commercially available thermal analysis mold and a customized potentiometric recorder to produce a temperature vs time curve. Dissert. Abstr.

N80-23421 Georgia Inst. of Tech., Atlanta.
STRESS CORROSION CHARACTERISTICS OF AL-Zn-Mg ALLOYS WITH COPPER ADDITIONS Ph.D. Thesis
Bhaskar Sarkar 1979 123 p
Avail: Univ. Microfilms Order No. 8010006

Four Al-6Zn2Mg-xCu alloys with similar microstructures but different copper contents were chosen to investigate the effect of copper in the stress corrosion cracking characteristics in an aqueous solution of 3.5% NaCl. The nominal copper contents were 0%, 1%, 1.6% and 2.1%. Stress corrosion cracking in this alloy system is intergranular and both anodic dissolution of grain boundary precipitates and hydrogen embrittlement are possible mechanisms. Precracked double cantilever beam specimens, loaded to constant crack opening displacements were used to determine the stress corrosion crack growth kinetics as a function of stress intensity. Increasing the copper content of the Al-Zn-Mg alloys in the -T651 condition was found to improve the SCC resistance. An overaging treatment improves the SCC characteristics of the copper-free alloy by increasing the homogeneity of deformation. The improvement in the copper-containing alloys is attributed to the eta phase becoming still less anodic (as compared to that in -T651 condition) because more copper enters the eta phase from solid solution during overaging. This further reduces the rates of electrochemical dissolution and/or hydrogen embrittlement. Dissert. Abstr.

N80-23422 Clarkson Coll. of Technology, Potsdam, N.Y.
DIRECTIONAL SOLIDIFICATION OF MANGANESE-BISMUTH/BISMUTH ALLOYS Ph.D. Thesis
P. S. Ravishankar 1980 227 p
Avail: Univ. Microfilms Order No. 8011197

Eutectic and off-eutectic alloy of MnBi/Bi were directionally solidified in a Bridgman-Stockbarger apparatus to determine the dependence of the fiber spacing on the growth parameters growth rate and interfacial temperature gradient. The growth rate was varied from 0.6 cm/hr to 30 cm/hr. Techniques were developed to measure the temperature profile in the melt and hence obtain the interfacial temperature gradient. Transverse sections of the solidified alloys were examined in a optical or scanning electron microscope and the fiber spacing measured. Fiber spacing varied as the inverse square root of growth rate as predicted by theory. The temperature gradient did not influence fiber spacing. This contradicts those claims that all faceted/non-faceted class of eutectics should show a temperature gradient influence. For the cases where such an influence was observed in the literature, a new hypothesis is proposed. The actual fiber spacing adjustment mechanism is not clear. Interface position measurements resulted in good agreement with the existing one dimensional heat transfer models. Dissert. Abstr.

N80-23423 Georgia Inst. of Tech., Atlanta.
THE EFFECTS OF DEFORMATION MODE ON THE BEHAVIOR OF Ti-28%V AND Ti-32%V ALLOYS Ph.D. Thesis
Tapas Kumar Mukhopadhyay 1979 99 p
Avail: Univ. Microfilms Order No. 8010566

Low cycle and high cycle fatigue tests were performed to determine the fatigue performance of Ti-28%V and Ti-32%V alloys in the metastable b.c.c. states under total strain and total load control modes. Effects of strain rate variation and spiked loading were also monitored. The planar slip Ti-32%V exhibited fatigue softening at low strain amplitudes and fatigue hardening at high strain amplitudes. The multiple (wavy) slip Ti-28%V alloy exhibited fatigue hardening at all strain amplitudes tested. A break in the Coffin Manson plot was observed at a strain amplitude of ~0.0035 for both of the alloys. A similar break was also observed in the cyclic stress-strain plot. A reduction in the strain rate by an order of magnitude affected the two alloys differently. The Ti-32%V planar slip material exhibited increased hardening with decreased strain rate, whereas Ti-28%V alloy with its higher twin fault probability exhibited a typical b.c.c. behavior. The multiple (wavy) slip Ti-28%V alloy exhibited a diminished fatigue life at all strain amplitudes as compared to that of the planar slip Ti-32%V alloy. Within the scatter-band, the high cycle fatigue life for the planar slip material and the multiple (wavy) ship material was found to be similar. This suggests that the macroscopic deformation mechanism does not dictate the high cycle fatigue life. Dissert. Abstr.

N80-23424 Georgia Inst. of Tech., Atlanta.
THE EFFECT OF MICROSTRUCTURE ON THE FATIGUE BEHAVIOR OF AN ALUMINUM-LITHIUM ALLOY Ph.D. Thesis
Edward James Coyne, Jr. 1979 145 p
Avail: Univ. Microfilms Order No. 8010565

The monotonic and fatigue behavior of an aluminum-lithium-manganese alloy was investigated. The properties of an aluminum-copper-lithium alloy, were examined in order to have a lithium alloy as a base for comparison. The Al-Li-Mn material was studied in an underaged, peak aged and overaged condition. The grain structure of the three heat treatments were the same while the different size precipitates were responsible for differences in deformation characteristics. The underaged and peak aged alloys deformed by planar slip. The larger particle size and interparticle spacing of the overaged condition resulted in a combination of planar slip and Orowan looping. The Al-Cu-Li alloy deformed primarily by planar slip. The fatigue crack propagation data show that the crack propagation rates of Al-Li-X alloys are less than those of other aluminum alloys at low stress intensity factors due to the high modulus and low crack opening displacement of these alloys. Dissert. Abstr.

N80-23425 Kentucky Univ., Lexington.
A SURFACE ANALYSIS STUDY OF CARBON MONOXIDE AND HYDROGEN ABSORPTION AND DESORPTION OF

Ni(3) CRYSTALS Ph.D. Thesis
James Lih-Ren Chao 1979 194 p
Avail: Univ. Microfilms Order No. 8011118

Low energy electron diffraction and Auger electron spectroscopy were used to analyze nickel single crystal surfaces in order to understand nickel catalytic reactivity. The adsorption and desorption of CO and H2 were investigated. An additional nickel sample with small angle boundaries was used to examine the effect on the reactivity of the discontinuity caused by the boundary lines. The sulfur poisoning problem was also investigated. Results discussed include desorption states, activation energy, and temperature and pressure effects. Dissert. Abstr.

N80-23426 Rensselaer Polytechnic Inst., Troy, N. Y.
FATIGUE CRACK PROPAGATION IN A DIRECTIONALLY SOLIDIFIED COBALT-BASE EUTECTIC Ph.D. Thesis
Curtiss Mitchell Austin 1979 153 p
Avail: Univ. Microfilms Order No. 8011496

Fatigue crack propagation (FCP) in a Co-base aligned eutectic, Cotac (Co-10Ni-10Cr-15TaC), was investigated extensively, with temperature, environment, frequency and load waveform and load waveform as experimental variables. Emphasis was directed toward the determination of the role of fibers, using interfiber spacing, fiber orientation, fiber integrity, and the absence of fibers as material variables. The FCP rates at high delta K are affected by most of these material variables, but are not affected by pre-existing fiber failure produced by prestraining. The FCP rates at low delta K are not affected by any of the material variables. Results indicate that fatigue crack propagation in Cotac is generally matrix controlled, provided that it is understood that at high delta K the matrix is influenced by the presence of fiber segments. At high delta K, the critical crack advance event occurs within a plastic zone containing only segmented fibers.
Dissert. Abstr.

N80-23427 Stanford Univ., Calif.
DIFFUSIONLESS TRANSFORMATIONS IN TITANIUM-NICKEL Ph.D. Thesis
Gary Max Michal 1980 295 p
Avail: Univ. Microfilms Order No. 8011682

Various techniques of high resolution transmission electron microscopy to obtain a more thorough characterization of the premartensitic and martensitic transformations in TiNi than previously obtainable. Using an electron microscope equipped with a LaB6 filament detailed aspects of the structure were obtained through structure and high resolution dark field imaging, in situ heating and cooling experiments and 2 1/2 D microscopy. The technique of 2 1/2 D electron microscopy is shown to have a much greater potential than previously thought in determining the orientation changes or difference in lattice plane spacings in crystalline solids. A theoretical model and experimental evidence are presented to determine the limit of how closely spaced diffraction vectors are and still be correlated with their microstructural features. The results indicate that diffraction spot separations of 0.5nm-1 can be measured and unambiguously correlated with features in the dark field stereo pair while maintaining an image resolution of lnm.Dissert. Abstr.

N80-23428 Stanford Univ., Calif.
KINETIC AND THERMODYNAMIC STUDIES OF LIQUID METAL-OXYGEN SYSTEMS USING SOLID STATE ELECTROCHEMICAL TECHNIQUES Ph.D. Thesis
Bahman Heshmatpour 1980 333 p
Avail: Univ. Microfilms Order No. 8011647

The influence of small additions of the solutes tin, lead, copper, silver and titanium on the diffusivity, the solubility, the activity and the activity coefficient of oxygen in liquid indium was studied for the temperature range 750 to 950 C using solid state electrochemical techniques. Sharp increases in oxygen diffusivity and decrease in oxygen solubility were observed in all cases when these solutes were added to indium. Modest increases in oxygen diffusivity were observed for higher solute concentrations. Oxygen showed Henrian behavior up to the maximum oxygen solubility for all the temperatures and solute concentrations. The results indicated that the addition of a less reactive metal to a more reactive metal increases the oxygen diffusivity and decreases the oxygen solubility in the more reactive metal. A solubility diffusivity correlation proved to be valid for all the indium-solute-oxygen systems. The thermodynamics of liquid binaries of indium-solutes were also studied using a solid oxide electrochemical method up to 10 atomic percent of these solutes. Dissert. Abstr.

N80-23429 Rensselaer Polytechnic Inst., Troy, N. Y.
CRYSTALLOGRAPHY IN FUSION-WELD-METAL SOLIDIFICATION MECHANICS Ph.D. Thesis
Jay Morris Samuel 1979 186 p
Avail: Univ. Microfilms Order No. 8011510

Extensive X-ray diffraction work and metallographic examination of bead-on-plate fusion welds in cube-on-face oriented silicon iron revealed the the substructure characteristics were controlled to a large extent by crystallographic considerations. It was observed that the substructure width increased with increasing angular deviation between the direction of G sub L and the nearest < 100 > crystallographic direction in the solid. Furthermore, it was also noted that the substructure growth mode gradually changed in appearance from a cellular to a cellular dendritic geometry as the angular deviation increased. These changes in substructure characteristics were attributed to a modification of the effective constitutional supercooling experienced at the growing cell tips as a result of the orientation of the cell axes with respect to the direction of G sub L.
Dissert. Abstr.

N80-23430*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRACTICAL APPLICATIONS OF SURFACE ANALYTIC TOOLS IN TRIBOLOGY
John Ferrante 1980 45 p refs Presented at the Intern. Lubrication Conf., San Francisco, 18-21 Aug. 1980; sponsored by ASME and ASLE
(NASA-TM-81484; E-422) Avail: NTIS HC A03/MF A01 CSCL 20K

A brief description of many of the widely used tools is presented. Of this list, those which have the highest applicability for giving elemental and/or compound analysis for problems of interest in tribology along with being truly surface sensitive (that is less than 10 atomic layers) are presented. The latter group is critiqued in detail in terms of strengths and weaknesses. Emphasis is placed on post facto analysis of experiments performed under real conditions (e.g., in air with lubricants). It is further indicated that such equipment could be used for screening and quality control. R.C.T.

N80-23431# Georgia Inst. of Tech., Atlanta. Fracture and Fatigue Research Lab.
QUANTITATIVE FRACTOGRAPHY OF A FATIGUED TI-28 W/O V ALLOY
Ervin E. Underwood and Saghana B. Chakrabortty 27 Nov. 1979 35 p refs
(Contract N00014-75-C-0349)
(AD-A079813; GIT-TR-79-1) Avail: NTIS HC A03/MF A01 CSCL 11/6

A quantitative fractographic analysis was undertaken to study the microstructural features important in the understanding of the mechanisms of fatigue crack growth and in the prediction of fatigue crack propagation rates. Special emphasis in this work is placed on the facet characteristics and sub-surface cracking. The stereological treatment of this problem develops methodologies and relationships based primarily on vertical sections through the fracture surface and parallel to the crack propagation direction. The evaluation of fracture profiles (in terms of true length, roughness, and degree of orientation) permits calculation of fracture surface characteristics (such as true surface area, roughness, and type of surface - the latter through an upper-lower bound approach). GRA

N80-23432# Air Force Materials Lab., Wright-Patterson AFB, Ohio. Mechanics and Surface Interactions Branch.
ADHESIVE BONDING EXPERIMENTS FOR TITANIUM 6 ALUMINUM 4 VANADIUM (Ti6Al4V). PART 1: ANODIZATION TREATMENTS Final Report, Jul. 1978 - Aug. 1979
William L. Baun Dec. 1979 42 p refs
(AF Proj. 2419)
(AD-A081538; AFML-TR-79-4172-Pt-1) Avail: NTIS HC A03/MF A01

Evaluations of surface treatments for adhesive bonding of Ti6Al4V were carried out using lap shear, peel and thick-thin wedge tests. Anodization to form dense oxides from 100-3000 A in thickness had little effect on bond strength or durability. Properties were governed by chemical pretreatments. Fluorine present in the anodization bath can cause oxide/alloy failures and should be avoided. GRA

N80-23433# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

AIRCRAFT CARRIER EXPOSURE TESTS OF ALUMINUM ALLOYS Progress Report

E. J. Jankowsky, S. J. Ketcham, and V. S. Agarwala 1 Nov. 1979 38 p refs

(ZF61542001)

(AD-A081060; NADC-79251-60) Avail: NTIS HC A03/MF A01 CSCL 11/6

An effort is underway to correlate results of accelerated laboratory corrosion tests with actual shipboard exposure of aircraft materials. This report describes the first of the series in which aluminum alloys with varying susceptibilities to exfoliation and stress corrosion were exposed on the flight deck of an aircraft carrier. Use of an electrochemical corrosion monitor to measure corrosivity of the environment is also described. GRA

N80-23434# Systems Research Labs., Inc., Dayton, Ohio. Research Applications Div.

MATERIALS EVALUATION. PART 2: DEVELOPMENT OF CORROSION INHIBITORS Final Report, Aug. 1976 - Jul. 1978

M. Khobaib Sep. 1979 65 p refs

(Contract F33615-76-C-5191; AF Proj. 7351)

(AD-A080905; SRL-6909-02-Pt-2; AFML-TR-79-4127-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 11/6

A borax-nitrite based inhibitor has been developed for incorporation into the Air Force Rinse Facility at MacDill Air Force Base. Chromate-based products, in combination with polyphosphates, have been reasonably effective against corrosion of ferrous and nonferrous metals and alloys and are presently the most widely used inhibitors. However, the use of chromates has been the subject of ecological concern, and the investigation discussed herein involves alternatives to chromates. The performance of nonchromate commercial inhibitors has been tested and a borax-nitrite based formulation developed which inhibits the corrosion of several ferrous and nonferrous metals and alloys. This mixture contains no chromates and offers important advantages over the chromate-polyphosphate combination. Corrosion-fatigue and crack-growth studies on aluminum alloys have shown a reduction of more than one order of magnitude in crack-growth rate in the presence of this inhibitor. In fact, the crack growth decelerates to the air-sample level with the use of the inhibitor, even in an aqueous environment of 0.1M NaCl solution. GRA

N80-23435# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

INHOMOGENEOUS BROADENING EFFECTS IN CW CHEMICAL LASERS Interim Report

Harold Mirels Los Angeles SAMSO Sep. 1979 66 p refs

(Contract F04701-78-C-0079; DARPA Order 2843)

(AD-A077319; TR-0079(4764)-1; SAMSO-TR-79-85) Avail: NTIS HC A04/MF A01 CSCL 20/5

The effects inhomogeneous broadening on the performance of CW chemical lasers were investigated. A simple two level vibrational model and a Fabry-Perot resonator were assumed. Laser performance was found to depend on certain parameters. The numerical results are given for a CW chemical laser with laminar diffusion and with a single longitudinal optical mode. The variation of differential number density with local lasing intensity and streamwise distance and the variation of net laser output power with tuning frequency are presented. The latter exibits a lamp dip near line center. Other significant results are presented. R.C.T.

N80-23436# Argonne National Lab., Ill. Materials Science Div.

SUPERPOSITION OF ALLOY HARDENING, STRAIN HARDENING, AND DYNAMIC RECOVERY

U. F. Kocks 1979 22 p refs Presented at the 5th Intern. Conf. on Strength of Metals and Alloys, Aachen, West Germany, Aug. 1979 Sponsored in part by Federal Republic of Germany

(Contract W-31-109-eng-38)

(CONF-790801-6) Avail: NTIS HC A02/MF A01

The principles and heuristics of flow stress superposition are illustrated for the case that one of the components is due to dislocation/dislocation interactions and is the only one that changes with strain. A simultaneous investigation of the flow stress and its rate sensitivity as a function of strain is described. It is shown that the slope of the observed stress strain curve depends on the form of the superposition law even if there is no physical influence of alloying on the dislocation storage rate; the frequently observed low initial strain hardening associated with a higher yield stress may in some cases be merely a consequence of a nonlinear superposition. It is also shown that higher strains, the influence of alloying a dynamic recovery becomes the predominant effect; it also controls the high temperature creep strength. When dynamic recovery plays an important role, it provides a further straining mechanism which, however, is not additive to the low temperature strain rate; a form of the superposition law for long range slip and this dynamic recovery strain is proposed. An application of these principles has demonstrated that dynamic strain aging is due to an effect of mobile solute atoms on the strain hardening component of the flow stress, not on the friction stress. DOE

N80-23437# California Univ., Livermore. Lawrence Livermore Lab.

MECHANICAL PROPERTIES OF COLD-WORKED 5083 ALUMINUM

M. E. Prado and J. J. Scott 6 Mar. 1979 16 p refs

(Contract W-7405-eng-48)

(UCID-18179) Avail: NTIS HC A02/MF A01

Tensile and fracture toughness tests of 25% cold worked 5083 aluminum and weld material were conducted. The tests showed that the aluminum is highly nonhomogeneous; its fracture toughness, elongation, and percent reduction in area varied greatly from point to point. This characteristic could significantly affect the design of 5083 applications. The weld material exhibited more uniform mechanical properties throughout the weld. However, its fracture toughness varied from 19 to 49 ksi in./sup 1/2/. The weld-joint geometry affects the fracture characteristics of the joint. DOE

N80-23438# Pennsylvania Univ., Philadelphia. Dept. of Metallurgy and Material Science.

METASTABLE PHENOMENA IN HYDROGEN DEGRADATION OF LOW CARBON ALLOY STEELS Interim Report, Dec. 1977 - Nov. 1978

L. S. Darken and E. R. Ryba EPRI Palto Alto, Calif. Sep. 1979 39 p refs

(EPRI-AF-1176) Avail: NTIS HC A03/MF A01

According to thermodynamic calculations, The inclusion of chromium and other strong carbide-forming elements in steels should significantly lower the activity of carbon so that methane does not form in hydrogen atmospheres at moderate temperatures. However, degradation of low alloy steels does occur, and it is suggested that a metastable equilibrium condition exists in which the carbon atoms cluster around the atoms of the alloying elements in the ferrite phase and assume a higher activity. This suggestion has now been substaniated by the results of carbonization experiments in which pure iron and iron-chronium alloys have been exposed to atmospheres of varying carbon activities at 600 C and 700 C. Measurement of weight changes by thermogravimetry clearly shows that the solubility of carbon in the alloy ferrite is in excess of that in pure iron. DOE

N80-23439# Ohio State Univ., Columbus. Dept. of Metallurgical Engineering.

HYDROGEN ATTACK OF STEEL Progress Report, 1 Apr. 1979 - 31 Mar. 1980

Paul G. Shewmon 2 Jan. 1980 9 p refs

(Contract EY-76-S-02-2872)

(COO-2872-04) Avail: NTIS HC A02/MF A01

The atomic processes by which the hydrogen attack of pressure vessel steel occurs were investigated by the following: the growth kinetics using an exceptionally sensitive dilatometer.

These data were compared with the predictions of models based on the postulated mechanisms. Scanning electron microscope studies were conducted to establish the geometry and location of the growing methane bubbles. The steels used were various commercial alloys because of the now confirmed suspicion that trace impurities, e.g., from dioxidation practice, play a central role in determining the nucleation and growth geometry of the bubbles or fissures. DOE

N80-23440# General Atomic Co., San Diego, Calif.
CREEP-RUPTURE BEHAVIOR OF 2-1/4Cr-1 Mo STEEL, ALLOY 800H AND HASTELLOY ALLOY X IN A SIMULATED HTGR HELIUM ENVIRONMENT
G. Y. Lai and R. J. Wolwowicz Dec. 1979 75 p refs
(Contract DE-AT03-76ET-35300)
(GA-A-15572) Avail: NTIS HC A04/MF A01

Testing was conducted in flowing helium containing nominal concentration of following gases: 1500 micron atm H2, 450 micronatm CO, 50 micronatm H2O and 5 micronatm CO2 to represent maximum permissible levels of impurities in the primary coolant for the steam-cycle system of a high-temperature gas-cooled reactor (HTGR) when it is operating continuously with a water and/or steam leak at technical specification limits. Two or three heats of material for each alloy were investigated. Tests were conducted a 482 C and 760 C (1200 F and 1400 F) for Alloy 800H, and at 760 C and 871 C (1400 F and 1600 F) for Hastelloy Alloy X for times up to 10,000 h. Selected tests were performed on same heat of material in both air and helium environment to make a direct comparison of creep-rupture behaviors between two environments. Metallurgical evaluation was performed on selected post test specimens with respect to gas-metal interactions which included oxidation, carburization and/or decarburization. Correlation between gaseous corrosion and creep-rupture behavior was attempted. Limited tests were also performed to investigate the specimen size effects on creep-rupture behavior in the helium environment. DOE

N80-23441# Ames Lab., Iowa.
HYDROGEN EMBRITTLEMENT IN VANADIUM SINGLE CRYSTALS
Shen-Ann Shei and Tom E. Scott 1979 4 p refs Presented at the 2nd Intern Symp. on Hydrogen in Metals, Minakami Spa, Japan, 26-29 Nov. 1979
(Contract W-7405-eng-82)
(ISM-249; CONF-791132-2) Avail: NTIS HC A02/MF A01

Mechanical properties of < 149 > oriented single crystals of high purity vanadium and hydrogen-charged vanadium were investigated in the temperature range from 77 K to 296 K. Cleavage fracture occurred in hydrogen-charged crystals tested at temperatures above and below the stress-free hydrogen solvus temperature. Fractographic studies show small whiskers along edges of cleavage steps. The effect of hydrogen on fracture behaviors and strengthening of vanadium is discussed. DOE

N80-23442# Hanford Engineering Development Lab., Richland, Wash.
CHEMICAL DECONTAMINATION OF METALS
Jerry A. Partridge and Ronald E. Lerch Oct. 1979 22 p refs Presented at the Am. Nucl. Soc. Meeting, San Francisco, 11-15 Nov. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1880; CONF-791103-66) Avail: NTIS HC A02/MF A01

A metal decontamination process based upon removal of contamination by treatment with a cerium (4) nitric acid solution (or other redox agent in nitric acid) is feasible and highly promising. The technique is effective in dissolving the surface layer of stainless steel. Dissolution rates of approximately 1.5 mils/h were demonstrated with cerium (4) nitric acid solutions. Removal of plutonium contamination from stainless steel was demonstrated in laboratory tests, in which activity levels were reduced from greater than 500,000 counts per minute to nondetectable levels in approximately one hour at 90C. Removal of paint from stainless steel surfaces was also demonstrated. Advantages of this process include: (1) There is potentially less waste generated; (2) cerium 4 in nitric acid is a good dissolution agent for plutonium oxide; (3) regeneration of Ce4 during the decontamination is accomplished by electrolysis; (4) the process should be effective for irregularly shaped equipment; (5) it could be effective as a spray or a flow-through system. DOE

N80-23443# Vacuumschmelze G.m.b.H., Hanau (West Germany).
DEVELOPMENT OF PERMANENT MAGNET ALLOYS Final Report
Robert Cremer, Christian Radeloff, and Irmtraud Pfeiffer Bonn Bundesmin. fuer Forsch. u. Technol. Aug. 1979 183 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-23) Avail: NTIS HC A09/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 38

The influence of phase transformations and precipitations on the mechanical and magnetic properties of magnetic alloys was investigated. A group of semihard magnetic alloys with rectangular hysteresis loop was developed for use in permanent reed switch applications. Production studies were made of magnetic alloys containing titanium. Author (ESA)

N80-23444# Kloeckner-Humboldt-Deutz A.G., Oberursel (West Germany).
FATIGUE AT HIGH TEMPERATURES: EXAMINATION OF THE BEHAVIOR OF GASTURBINE CASTING MATERIALS ALSO IN SIMULTANEOUS TEMPERATURE AND STRAIN CYCLES Final Report
Arnold Witt and Manfred Pucher Bonn Bundesmin. fuer Forsch. u. Technol. Jul. 1979 102 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-79-26) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 21

Test equipment that allows an examination of the effects of low cycle fatigue of nickel based cast alloys is described. It is possible to simultaneously vary temperature and compression-tension strain cycles of precision cast alloy samples. A hollow cylindrical sample was investigated in terms of the number of cracks as a function of temperature, dwell times for tension and compression, cycle period, strain rate, and alteration of temperature and strain. Author (ESA)

N80-23445# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MECHANICAL MODELIZATION OF MICROSTRUCTURAL INSTABILITIES IN CYCLIC VISCOPLASTICITY AT VARIABLE TEMPERATURE Thesis - Paris VI Univ.
Georges Cailletaud 1979 76 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-611)
(ONERA-NT-1979-6; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

The time dependent temperature variations modifying the mechanical properties of the nickel alloy IN100 were studied along with the microstructural instabilities producing the modifications. In the framework of thermodynamics, with internal variables and using phenomenological remarks, a mathematical model was developed. The model is described. Author (ESA)

N80-23446# Vereinigte Aluminium-Werke A.G., Bonn (West Germany). Leichtmetall-Forschungsinst.
ELECTRON BEAM MELT-HARDENING OF ALUMINUM ALLOYS Final Report
Barbara Grzemba, Gerhard Ibe, and Walther Hiller Bundesmin. fuer Forsch. u. Technol. Aug. 1979 92 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. Prepared in cooperation with Steigerwald-Strahltechnik G.m.b.H., Munich
(BMFT-FB-T-79-20) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 18.90

Several binary aluminum alloys were subjected to melting and solidification. Subsequently, the mechanical properties of these alloys were studied. After surface melting and rapid solidification, aluminum-iron alloys showed tensile strengths which, in the temperature range of 200 C to 300 C, exceeded the tensile strengths of their known heat resistant aluminum alloys. Electron beam techniques were used to melt a surface layer of other

aluminum alloys resulting in aluminum materials of high wear resistance. Author (ESA)

N80-23447# European Space Agency, Paris (France).
ANALYSIS OF POSSIBLE IMPROVEMENTS OF ALLOYS DUE TO DIRECTIONAL EUTECTIC SOLIDIFICATION IN ZERO GRAVITY CONDITIONS
Hans Ahlborn and Ruediger Rothe Nov. 1979 57 p refs Transl. into ENGLISH of "Analyse der Erreichbaren Verbesserungen bei Legierungen Aufgrund Gerichteter Eutektischer Erstarrung unter Weltraumbedingungen", Rept. BMFT-FB-W-77-15 BMFT and Hamburg Univ., Bonn., Dec. 1977 Original report in GERMAN previously announced as N79-30371
(ESA-TT-575; BMFT-FB-W-77-15) Avail: NTIS HC A04/MF A01; ZLDI, Munich DM 13.50

Eutectic alloys having undergone directional solidification in a temperature gradient already in use, being developed, and/or known from the literature were analyzed for their mechanical, electrical, magnetic, and optical properties. These characteristics were evaluated with respect to possible improvement through production in space. Results show that with the absence of thermal convection which affects the formation of structures on Earth, an improvement in the microstructure and hence in the properties of the alloys can be expected from zero gravity manufacture. It is anticipated that space processing will in particular bring advantages for eutectics whose properties are substantially influenced by the regularity of the structure, e.g., eutectics intended for optical applications. Author (ESA)

N80-23448# National Physical Lab., Teddington (England). Quantum Metrology Div.
LOW TEMPERATURE DATA HANDBOOK TITANIUM AND TITANIUM ALLOYS
D. R. Salmon May 1979 286 p refs
(NPL-QU-53) Avail: NTIS HC A12/MF A01

Values for tensile properties, elastic modulus, impact strength, fatigue strength, fracture properties, creep, electrical resistivity, specific heat, thermal conductivity, thermal expansion, and magnetic properties are presented for titanium and the following alloys: Ti6Al4V, Ti5Al2.5Sn, Ti8Al1Mo1V, and Ti13V-11Cr3Al. Author (ESA)

N80-23449# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
GUST SEVERITY EFFECTS ON FATIGUE CRACK PROPAGATION IN ALUMINUM ALLOY SHEET MATERIALS
R. J. H. Wanhill Dec. 1978 21 p refs Submitted for publication Sponsored by Netherlands Agency for Aerospace Programs and Dutch Civil Aviation Board
(NLR-MP-78041-U) Avail: NTIS HC A02/MF A01

Flight simulation fatigue tests were conducted to investigate the effect of differing gust load experiences on fatigue crack propagation in 7075-T6 and the effect of gust load alleviation on 2024-T3. Two gust spectra were used: the Fokker F-27 spectrum and the reference spectrum TWIST. A large systematic effect of gust severity on crack propagation rates in 7075-T6 was correlated by the stress intensity factor for the rms of the gust amplitudes. Author (ESA)

N80-23450# National Technical Information Service, Springfield, Va.
POWER METALLURGY OF TITANIUM AND TITANIUM ALLOYS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jan. 1980
William E. Reed Feb. 1980 288 p Supersedes NTIS/PS-79/0126; NTIS/PS-78/0130 and NTIS/PS-77/0002
(PB80-805161; NTIS/PS-79/0126; NTIS/PS-78-0130; NTIS/PS-77/0002) Avail: NTIS HC $30.00/MF $30.00 CSCL 11F

Citations of worldwide research on powder pressing, sintering, forging, compacting, and extruding are covered. Studies on properties and structure of powdered metal products, TiC-containing alloys, tools and aircraft parts are included. This updated bibliography contains 281 abstracts, 27 of which are new entries to the previous edition. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N80-23451 Wisconsin Univ. - Madison.
STRESS-BIREFRINGENCE-STRAIN RELATIONS IN POLYMER NETWORKS WITH SPECIALLY DESIGNED STRUCTURES Ph.D. Thesis
Hsin-Chia Kan 1979 344 p
Avail: Univ. Microfilms Order No. 8004724

Strips of linear 1,2-polybutadiene were cross-linked near its glass transition temperature by gamma irradiation while strained in uniaxial extension with a stretch ratio gamma sub o, with very little relaxation at gamma sub o before cross-linking. After release and warming, the sample retracts to a state of ease gamma sub s. The stress-strain relation in uniaxial extension from the state of ease is accurately represented by a two network model with cross-links and trapped entanglements; the first with neo-Hookean elasticity and the second with a Mooney-Rivlin stress-strain relation. The corresponding birefringence-strain relation is also accurately described by the two network model with respective stress-optical coefficients for the two individual networks. Dissert. Abstr.

N80-23452* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REVERSE OSMOSIS MEMBRANE OF HIGH UREA REJECTION PROPERTIES Patent
Catherine C. Johnson and Theodore J. Wydeven, inventors (to NASA) Issued 22 Apr. 1980 6 p Filed 9 Jun. 1976 Supersedes N77-18265 (15 - 09, p1152)
(NASA-Case-ARC-10980-1; US-Patent-4,199,448; US-Patent-Appl-SN-694407; US-Patent-Class-210-23H; US-Patent-Class-204-171; US-Patent-Class-210-500M; US-Patent-Class-427-41; US-Patent-Class-427-245) Avail: US Patent and Trademark Office CSCL 11G

Polymeric membranes suitable for use in reverse osmosis water purification because of their high urea and salt rejection properties are prepared by generating a plasma of an unsaturated hydrocarbon monomer and nitrogen gas from an electrical source. A polymeric membrane is formed by depositing a polymer of the unsaturated monomer from the plasma onto a substrate, so that nitrogen from the nitrogen gas is incorporated within the polymer in a chemically combined form.
Official Gazette of the U.S. Patent and Trademark Office

N80-23453*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDY OF METHODS FOR PROVIDING THERMAL SHOCK RESISTANCE TO PLASMA-SPRAYED CERAMIC GAS-PATH SEALS
Robert C. Bill (AVRADCOM Res. and Technol. Labs.), Donald W. Wisander, and David E. Brewe (AVRADCOM Res. and Technol. Labs.) May 1980 24 p refs
(NASA-TP-1561; E-9941; AVRADCOM-TR-79-28) Avail: NTIS HC A02/MF A01 CSCL 11G

The cyclic thermal shock resistance of several outer air, gas path seal systems for high pressure turbines was evaluated. In all these systems, plasma sprayed, yttria stabilized ZrO2 was the ceramic constituent. The most promising approaches were those that had a porous-metal, low modulus pad as a strain isolator between the ceramic layer and the dense metal substrate. Cooling pins extending into the low modulus pad significantly reduced the oxidation rate of the porous metal and the extended seal life. The thermal shock resistance of ceramic layer was improved by increasing its porosity and by precracking it before thermal shock testing. Microstructural and probe studies suggested that the long term durability of the high-pressure turbine seal systems would be adversely affected if the metal ceramic interfaces exceeded about 800 C because some metallic species would rapidly diffuse. Author

N80-23454*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ADJUSTABLE HIGH EMITTANCE GAP FILLER Patent Application

Howard E. Goldstein, Carlos Estrella, Marnell Smith, David A. Stewart, and Daniel B. Leiser (Stanford Univ.) Filed 7 May 1980 17 p
(NASA-Case-ARC-11310-1; US-Patent-Appl-SN-147700) Avail: NTIS HC A02/MF A01 CSCL 11G

A flexible, adjustable refractory filler is disclosed for filling gaps between ceramic tiles forming the heat shield of a space shuttle vehicle, to protect its aluminum skin during atmospheric re-entry. The easily installed and replaced filler consists essentially of a strip of ceramic cloth coated, at least along both its longitudinal edges with a room temperature vulcanizable silicone rubber compound with a high emittance colored pigment. The filler may have one or more layers as the gap width requires. Preferred materials are basket-weave aluminoborosilicate cloth, and a rubber compounded with silicon tetraboride as the emittance agent and finely divided borosilicate glass containing about 7.5% B203 as highly temperature binder. The filler cloth strip or tape is cut to proper width and length, inserted into the gap, and fastened with previously applied drops of silicone rubber adhesive. NASA

N80-23455*# Pennwalt Corp., King of Prussia, Pa. Central Research and Development.
DEVELOPMENT OF A SPECIAL PURPOSE SPACECRAFT COATING, PHASE 4 Technical Report, 30 May 1978 - 30 May 1979
H. D. Gillman May 1980 14 p refs
(Contract NAS9-14403)
(NASA-CR-160586) Avail: NTIS HC A02/MF A01 CSCL 11G

Coating formulations based on a fluorocarbon resin were evaluated for use on spacecraft exteriors. Formulations modified with an acrylic resin were found to have excellent offgassing properties. A much less expensive process for increasing to solid content of the fluorocarbon latex was developed. R.C.T.

N80-23456*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORMATION OF POROUS SURFACE LAYERS IN REACTION BONDED SILICON NITRIDE DURING PROCESSING
N. J. Shaw and T. K. Glasgow 1979 24 p refs Presented at the Fall Meeting of the Basic Sci. and Nucl. Div. of the Am. Ceramic Soc., New Orleans, 14-17 Oct. 1979
(NASA-TM-81493; E-431) Avail: NTIS HC A02/MF A01

An effort was undertaken to determine if the formation of the generally observed layer of large porosity adjacent to the as-nitride surfaces of reaction bonded silicon nitrides could be prevented during processing. Isostatically pressed test bars were prepared from wet vibratory milled Si powder. Sintering and nitriding were each done under three different conditions:(1) bars directly exposed to the furnance atmosphere; (2) bars packed in Si powder; (3) bars packed in Si3N4 powder. Packing the bars in either Si of Si3N4 powder during sintering retarded formation of the layer of large porosity. Only packing the bars in Si prevented formation of the layer during nitridation. The strongest bars (316 MPa) were those sintered in Si and nitrided in Si3N4 despite their having a layer of large surface porosity; failure initiated at very large pores and inclusions. The alpha/beta ratio was found to be directly proportional to the oxygen content; a possible explanation for this relationship is discussed. R.C.T.

N80-23457# Celanese Research Co., Summit, N.J.
PROCESSING MECHANISMS, STRUCTURE AND MORPHOLOGY OF HIGH TEMPERATURE POLYMERIC ALLOYS, PART 2 Final Technical Report, 1 Feb. 1977 - 31 Jan. 1979
Ian L. Hay, Jay R. Shaner, Peter Sullivan, Ted T. L. Chang, and Richard R. Kemmerer Mar. 1979 64 p refs
(Contract F49620-77-C-0046; AF Proj. 2303)
(AD-A080068; AFOSR-78-0954TR-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 11/9

The processing conditions expected to optimize interactions at a molecular level between poly (bisbenzimidazobenzophenanthroline) (BBB) and polybenzimidazole (PBI) have been investigated and the reaction products evolved under these conditions examined. Studies of the mechanical properties and the morphology indicate that binary interactions between BBB-BBB, PBI-PBI and BBB-PBI may all be occurring. The BBB-BBB interactions occur at temperatures greater than 500 C but PBI-PBI and BBB-PBI interactions arise at temperatures more than 100 C lower. Mass spectroscopic studies indicate that the principal reaction products in the presence of PBI are water and phenol whereas with BBB alone only water is evolved. Moreover in the mixture of BBB-PBI, phenol is evolved at lower temperatures than is the case with PBI alone. Possible end group reactions and reactions with partially cyclized rings, consistent with the observed evolution of water and phenol, are proposed for the improved processability of BBB in the presence of PBI. Further work to confirm the proposed reactions and the use of other additives to enhance these reactions is recommended. GRA

N80-23458# Columbia Univ., New York. Dept. of Chemistry.
PREPARATION OF POLYMERS USING METAL-CARBENES Technical Report, 1 Aug. 1979 - 7 Feb. 1980
Thomas J. Katz, Steven J. Lee, and Michael A. Shippey 7 Feb. 1980 22 p refs Submitted for publication
(Contract N00014-79-C-0683; Grant NSF CHE-77-22726; NR Proj. 356-726)
(AD-A080891; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/3

Metal-carbenes initiate the polymerizations of cycloalkenes to polyalkenamers that are stereoselectively cis, cyclic trisubstituted olefins to polymers that are translationally invariant, and acetylenes to polyacetylenes. Some implications are described. GRA

N80-23459# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
DEVELOPMENT OF HIGH TEMPERATURE SILICONE BASE FIRE-RESISTANT HYDRAULIC FLUID Final Report
Alfeo A. Conte, Jr. and J. Lee Hammond 5 Feb. 1980 75 p refs
(WF41451208)
(AD-A081597; NADC-79248-60) Avail: NTIS HC A04/MF A01 CSCL 11/8

A candidate silicone-base fire-resistant hydraulic fluid designated Nadraul MS-6 has been developed for future military aircraft hydraulic system design. The lubricating ability of this fluid has been demonstrated in hydraulic pump-loop circuit evaluations at 20.7 MPa (3000 PSI) and 55.2 MPa (8000 PSI) fluid pressures and at a fluid temperature as high as 163C (325F). Chemical and physical properties have been determined to establish both specification and hydraulic system design criteria and are reported herein. GRA

N80-23460# Massachusetts Inst. of Tech., Cambridge. Energy Lab.
SINTERABLE POWERS FROM LASER DRIVEN REACTIONS Annual Report, 1 Jul. 1978 - 30 Jun. 1979
John S. Haggerty and W. Roger Cannon Jul. 1979 126 p refs
(Contract N00014-77-C-0581; ARPA Order 3449)
(AD-A081709; MIT-EL-79-047; AR-2) Avail: NTIS HC A07/MF A01 CSCL 11/2

Extremely fine, uniform ceramic powders were synthesized from laser heated gas phase reactions. Resulting Si, Si3N4 and SiC powders have been characterized in terms of parameters which are important for densification processes. They are virtually ideal. The spherical particles typically have mean diameters from 120 to 1000 angstrom. The standard deviation is typically 25-45% and the diameter of the largest observed particle is typically less than twice that of the smallest particle. Purities are extremely high. The laser heated process has been modeled in terms of fluid flow and heat transfer criteria. Many fundamental property measurements were made to provide data for these calculations. The process is extremely efficient; approximately 95% of the SiH4 is reacted in a single pass through the laser beam and approximately 2 kwhr. of energy are required per kilo of Si3N4. GRA

N80-23461# Dayton Univ. Research Inst., Ohio.
SURFACE CONTAMINATION OF ADHESIVE BONDING MATERIALS Final Report, Jan. 1978 - Sep. 1979
W. L. Baun (AFML) and J. S. Solomon Wright-Patterson AFB,

Ohio AFML Dec. 1979 57 p refs Presented at Symp. on Contamination, Washington, D.C., Sep. 1978
(Contract F33615-76-C-5185; AF Proj. 2419)
(AD-A081316; AFML-TR-79-4165) Avail: NTIS HC A04/MF A01 CSCL 11/1

The surface composition of adherend materials, as received, is usually entirely different from the bulk and generally unsuitable for adhesive bonding. Consequently, prebonding treatments of adherend surfaces are usually necessary to remove unwanted chemical species and to modify the surface chemistry and topography in order to produce a strong and durable bond. Auger electron spectroscopy, ion scattering spectroscopy, and secondary ion mass spectroscopy were used to characterize adhesive bonding materials as received and at various prebonding stages. The presence of contaminants or undesirable materials has been traced to manufacturing processes, prebonding treatments, and environment. In many instances the presence of contaminants or unwanted materials has been directly related to poor bond performance. GRA

N80-23462# Akron Univ., Ohio. Inst. of Polymer Science.
THE ROLE OF CHEMICAL BONDING IN ADHESION Annual Report
A. N. Gent and P. Dreyfuss Feb. 1980 34 p refs
(Contract N00014-76-C-0408; NR Proj. 092-555)
(AD-A081661; TR-4) Avail: NTIS HC A03/MF A01 CSCL 13/8

Progress in three different phases of our study of the role of chemical bonding in adhesion is summarized in this report. Phase one consisted of an experimental study of the self-adhesion of thin layers of three crosslinked elastomers; namely, cispolyisoprene (natural rubber) and two polybutadienes. For the polybutadienes, the strength of self-adhesion was found to be strongly dependent upon the time of exposure of the two surfaces to air before they were brought into contact. The same phenomenon did not take place on exposure to nitrogen nor for samples of cispolyisoprene and it was reduced or delayed in samples containing antioxidant. It was therefore attributed to surface oxidation reactions that can lead to interfacial covalent bonds with polybutadiene but not with polyisoprene. Phase two consisted of a study of the effect of the number of chemical bonds at an interface between glass and polybutadiene on the joint strength of the adhesive bond formed between them. GRA

N80-23463# Brown Univ., Providence, R. I. Dept. of Chemistry.
COMPARATIVE RAMAN STUDY OF MIXED-ALKALI AND SIMILAR ION EXCHANGED GLASSES
Charles Windisch and William M. Risen, Jr. 10 Dec. 1979 39 p refs Submitted for publication
(Contract N00014-75-C-0883; NR Proj. 051-539)
(AD-A080840; TR-79-02) Avail: NTIS HC A03/MF A01 CSCL 11/2

The Raman spectra of analogous ion exchanged and mixed alkali disilicate and aluminodisilicate glasses of the same relative composition of dissimilar cations have been determined and employed to investigate the origin of the similarity of the mechanical loss features exhibited by them. Ion exchange of Na- for Lin Li2O-Al2O3-2SiO2 glasses is shown to yield glasses whose network structure is different from that of the mixed alkali glasses of the same stoichiometry, but to attain that structure upon annealing. The network structure of ion exchanged and conventionally mixed alkali disilicate glasses are apparently identical. These results are interpreted in light of the mechanical loss spectra of the analogous glasses prepared in the two ways. GRA

N80-23464# Brown Univ., Providence, R. I. Dept. of Chemistry.
TOWARD AN UNDERSTANDING OF THE MECHANICAL MIXED ALKALI EFFECT IN GLASSES
Costas H. Tzinis 10 Dec. 1979 24 p refs Submitted for publication
(Contract N00014-78-C-0883; NR Proj. 051-539)
(AD-A080751; TR-79-04) Avail: NTIS HC A02/MF A01 CSCL 11/2

The mechanical properties of mixed alkali glasses have been analyzed in order to determine their common features, including systematic variations with composition, and to define clearly the phenomena that must be explained. New assignments of the mechanical loss peaks are made, and approaches to developing a cooperative theory for the phenomena, especially the compositional variation of the peak temperatures and loss tangents, are presented and discussed. GRA

N80-23465# Montana Energy and MHB Research and Development Inst., Inc., Butte.
THERMAL CONDUCTIVITY AND DIFFUSIVITY OF ENGINEERING CERAMICS Final Report, 15 Sep. 1978 - 14 Sep. 1979
G. E. Youngblood and Larry D. Bentsen Nov. 1979 139 p refs
(Contract N00014-78-C-0726)
(AD-A078540; Rept-4TC-NAVY-F/79) Avail: NTIS HC A07/MF A01

This report summarizes the results of a one year research program devoted to an investigation of the effect of compositional and microstructural variables on the thermal conductivity/diffusivity of engineering ceramics. Particular emphasis was placed on studies of thermal transport phenomena in composite materials. A total of six completed studies have resulted during this program, with another four in progress, as follows: (1) Effect of Crystallization on the Thermal Diffusivity of a Cordierite Glass-Ceramic; (2) Thermal Diffusivity of Ba/Mica/Alumina Composites; (3) Thermal Diffusivity of Al2O3 with Dispersed Monoclinic and Tetragonal ZrO2 particles; (4) Effect of thermal Expansion Mismatch on the Thermal Diffusivity of Glass-Ni Composites; (5) Simple Laser Pulse Calorimeter; (6) Thermal Diffusivity/Conductivity of Dense Magnesia/Magnesia-Alumina Spinel Ceramic; (7) Thermal Diffusivity of Al2O3/SiC Composites; (8) Thermal Diffusivity of MgO/SiC Composites; (9) Thermal Diffusivity of Al2O3/TiC Composites; (10) Thermal Diffusivity of a Partially Electronic Conducting Ceramic: Yttrium Chromites. GRA

N80-23466# Dayton Univ. Research Inst., Ohio.
STRUCTURE MODIFICATION OF FLUOROCARBON ETHER BIBENZOXAZOLE POLYMERS TO IMPROVE HYDROLYTIC STABILITY Final Report, Jun. 1975 - May 1978
R. C. Evers, G. J. Moore, and J. L. Burkett Wright-Patterson AFB, Ohio AFML Oct. 1979 37 p refs
(Contract F33615-75-C-5095; AF Proj. 2419)
(AD-A078954; AFML-TR-79-4149) Avail: NTIS HC A03/MF A01

Hydrolytically and thermooxidatively stable fluorocarbon ether bibenzoxazole (FEB) polymers were synthesized by the acetic acid-promoted polycyclocondensation of fluorocarbon ether bis (o-aminophenol) monomers with novel fluorocarbon ether dithioimidate ester monomers. The dithioimidate esters were derived from hexafluoropropylene oxide (HFPO) or, preferably, from a combination of tetrafluoroethylene oxide (TFEO) and HFPO. The latter class of TFEO:HFPO-derived dithioimidate esters was tailored to impart improved hydrolytic stability to the resultant FEB polymers while minimizing undesirable, concomitant increases in polymer glass transition temperatures (Tg). The polymers were obtained in moderate-to-high molecular weight and exhibited inherent viscosities in the range of 0.20 to 0.41 dl/g. Polymer structures were verified by elemental and infrared spectral analysis. Lower polymer Tg's were obtained with increased fluorocarbon ether content, a minimum value of -48 C (-55 F) being achieved. High thermooxidative stability of the HFPO- and TFEO:HFPO-based FEB polymers was substantiated by thermogravimetric analysis and isothermal aging studies in air. After isothermal aging in air for 200 hours at 288 C (550 F) and 260 C (500 F), respresentative polymers exhibited weight losses of 17 and 7 percent, respectively. Hydrolytic stability of the polymers was evaluated by exposure to a 95 percent relative humidity, 93 C (200 F) environment for prolonged periods of time. Based on comparative polymer Tg, inherent viscosity and infrared spectral data, the HFPO- and TFEO:HFPO-based FEB polymers exhibited vastly improved hydrolytic stability over analogous TFEO-based FEB polmers. GRA

N80-23467# Dayton Univ. Research Inst., Ohio.
DYNAMIC MECHANICAL MEASUREMENT OF POLYPHENYLSULFONE (RADEL) Interim Report, Jul. - Dec. 1978

C. Ying-Cheung Lee, Jacque D. Henes, and Thomas E. Grossman
Wright-Patterson AFB, Ohio AFML Jun. 1979 37 p refs
(Contract F33615-78-C-5126; AF Proj. 2419)
(AD-A077281; UDR-NM-TR-79-07; AFML-TR-79-4062) Avail: NTIS HC A03/MF A01 CSCL 11/9

The dynamic response of Polyphenylsulfone (Radel) was measured with the Rheometrics Mechanical Spectrometer in different modes: Torsional Bar, Tensile, 3 Point-Bending, and Parallel Plates. The measurements cover a temperature range from -150 C to 380 C. Two secondary transitions below the glass transition have been identified and their relaxation activation energies are evaluated. The region above the glass transition temperature was characterized by Parallel Plates measurement and a maximum similar to the liquid-liquid transition was observed. Viscosity in this region was also measured as a function of frequencies. A Master Curve was constructed from the Torsion and Parallel Plates data, and the frequency shift parameters were fitted to the WLF equation. GRA

N80-23468# Naval Research Lab., Washington, D. C. Applied Mechanics Branch.
SHOCK AND VIBRATION PERFORMANCE OF AN EPOXY CHOCKING COMPOUND Final Report, Oct. 1977 - Sep. 1979
E. W. Clements Dec. 1979 47 p refs
(AD-A078496; NRL-MR-4128) Avail: NTIS HC A03/MF A01 CSCL 11/9

For some years, various epoxy compounds have been used to form machinery/equipment chocks on merchant ships. In application, the item to be mounted is located and aligned, and supported in place by some temporary means while the chocking compound is mixed and poured in place. The advantages are speed, economy and intimacy of fit compared to conventional methods. More recently, these compounds have been used to a limited extent on Navy combatants, where shock and vibration environments are much more severe than those encountered in the mercantile fleet. In order to evaluate the ability of poured epoxy chocks to withstand these environments, two structures have been constructed which resemble equipment items which have been so mounted on combatants in terms of mounting footprint, weight and overturning moment. These have been subjected to shock and vibration tests similar to those required by the Navy for acceptance of shipboard equipment. The epoxy chocks were unaffected by the vibration test, while under shock test they sustained minor cracking and spalling, but without significant reduction of load-bearing area and no impairment of alignment function. It was concluded that their performance was satisfactory for the test situations employed. It should be cautioned, however, that other environmental factors (temperature, humidity, contaminants, etc.) than those considered here may also be effective, and that other mechanical situations might modify the results observed. Such factors should be evaluated for any contemplated installation. GRA

N80-23469# National Technical Information Service, Springfield, Va.
THE CHEMISTRY OF SILICONE RESINS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1978
Diane M. Cavagnaro Feb. 1980 184 p
(PB80-804362) Avail: NTIS HC $30.00/MF $30.00 CSCL 07C

This bibliography pertains to the synthesis, polymerization, and chemical reactions of silicone and silicon-containing polymers and copolymers. The citations discuss grafting and crosslinking reactions, radiation polymerization, and spectra and molecular structure as they relate to their properties. This updated bibliography contains 177 abstracts, none of which are new entries to the previous edition. GRA

N80-23470# National Materials Advisory Board, Washington, D. C.
FIRE-RESISTANT HYDRAULIC FLUIDS IN ENCLOSED MARINE ENVIRONMENTS Final Report
1979 72 p refs
(Contract MDA903-78-C-0038)
(PB80-125545; NMAB-345) Avail: NTIS HC A04/MF A01 CSCL 11H

The status of research directed toward the reduction of fire hazards associated with hydraulic systems was reviewed. Particular attention was given to the problems associated with the search of less flammable hydraulic fluids. The nature and significance of tests to evaluate the flammability of candidate fluids and such practical considerations as toxicity and corrosivity, which affect the selection and use of hydraulic fluids, were emphasized. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N80-23471* National Aeronautics and Space Administration. Pasadena Office, Calif.
PROCESS FOR THE LEACHING OF AP FROM PROPELLANT Patent
Graham C. Shaw (Thiokol Corp., Brigham City, Utah) and Meldon J. McIntosh, inventors (to NASA) (Thiokol Corp., Brigham City, Utah) Issued 15 Apr. 1980 7 p Filed 29 Sep. 1978 Supersedes N79-10227 (17 - 01, p 0031) Sponsored by NASA
(NASA-Case-NPO-14109-1; US-Patent-4,198,209; US-Patent-Appl-SN-946990; US-Patent-Class-23-302R; US-Patent-Class-149-108.4; US-Patent-Class-23-302T; US-Patent-Class-23-300; US-Patent-Class-23-302A) Avail: US Patent and Trademark Office CSCL 21I

A method for the recovery of ammonium perchlorate from waste solid rocket propellant is described wherein shredded particles of the propellant are leached with an aqueous leach solution containing a low concentration of surface active agent while stirring the suspension.

Official Gazette of the U.S. Patent and Trademark Office

N80-23472*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE IMPACT OF FUELS ON AIRCRAFT TECHNOLOGY THROUGH THE YEAR 2000
Jack Grobman and Gregory M. Reck 1980 26 p refs Presented at the Intern. Meeting and Tech. Display: Global Technol. 2000, Baltimore, 5-11 May 1980; sponsored by AIAA
(NASA-TM-81492; E-429) Avail: NTIS HC A03/MF A01 CSCL 21D

The impact that the supply, quality, and processing costs of future fuels may have on aircraft technology is assessed. The potential range of properties for future jet fuels is discussed along with the establishment of a data base of fuel property effects on propulsion system components. Also, the evolution and evaluation of advanced component technology that would permit the use of broader property fuels and the identification of technical and economic trade-offs within the overall fuel production-air transportation system associated with variations in fuel properties are examined. M.G.

N80-23473# Arizona Univ., Tucson. Dept. of Chemistry.
EXPLORING NEW CONCEPTS FOR ELUCIDATING PROCESSES OCCURRING IN PYROTECHNIC FLARES AND FOR GENERATING AEROSOL DISPERSIONS Final Report
M. Bonner Denton Sep. 1979 33 p refs
(Contract N00019-78-C-0512)
(AD-A080731) Avail: NTIS HC A03/MF A01 CSCL 19/1

Efforts leading to the development of successful techniques for mapping burning pyrotechnic flares are described. An experimental system capable of studying a variety of combustion processes under 'noisy' and 'smoky' conditions on a time scale appropriate for combusting flare candles is presented. Fundamental investigations designed to elucidate critical design parameters in Babington Nebulizers for application as high density aerosol generators are described. GRA

N80-23474# Suntech, Inc., Marcus Hook, Pa.
RESEARCH ON DIAMANTANE AND OTHER HIGH DENSITY HYDROCARBON FUELS
Final Report, 1 Jun. 1978 - 30 Jun. 1979

A. Schneider and H. K. Myers Wright-Patterson AFB, Ohio AFAPL Oct. 1979 93 p refs
(Contract F33615-78-C-2037; AF Proj. 3048)
(AD-A080749; AFAPL-TR-79-2080) Avail: NTIS HC A05/MF A01 CSCL 21/4

This report describes the preparation of (a) diamantane, (b) exo-tetrahydro-tricyclopentadiene, (c) the hydrogenated product of isomerized endo, endo-di(norbornadiene), and (d) some precursors of polyalkyldiamantanes. GRA

N80-23475# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab Section.
PROPELLANT SURVEILLANCE REPORT LGM-30 A AND B STAGE 1, TP-H1011
John A. Thompson Nov. 1979 110 p
(AD-A081493; MANCP-425(79)) Avail: NTIS HC A06/MF A01 CSCL 21/9

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30 A and B First Stage Minuteman Motors. Testing was accomplished in accordance with MMWRM Project M82934C-WNL17514. The purpose of testing was to determine and provide early warning of any serious degradation trends in the propellant for service life predictions. An analysis of all parameters indicates that no potential problems are expected in the propellant for at least two years past the oldest data point. Data stored in the GO85 System were plotted utilizing the IBM 360-65 Computer and CAL-COMP Plotter. The data range at any age can be found by suitable inquiry of the GO85 System. Each point on the regression plot represents the mean of all samples at that particular age. The number of specimens at each point is indicated on the sample size summary sheet accompanying each regression plot or group of regression plots. GRA

N80-23476# Institute for Industrial Research and Standards, Dublin (Ireland). Information Technology Group.
RETROSPECTIVE SEARCH ON THE BIOCHEMICAL PRODUCTION OF ALCOHOL FUELS
Jul. 1979 233 p Prepared in cooperation with National Board for Science and Technology, Dublin
(NP-24137) Avail: NTIS (US Sales Only) HC A11/MF A01; DOE Depository Libraries

The production of alcohol from a wide variety of carbohydrate and cellulose sources from 1957 to 1979 is discussed. Some general information relating to the bioconversion process and alcohol fuels is also included. DOE

N80-23477# Argonne National Lab., Ill.
ENVIRONMENTAL ASSESSMENT OF THE UTILIZATION OF ALCOHOL FUELS IN HIGHWAY VEHICLE APPLICATIONS
Oreste M. Bevilacqua and Martin J. Bernard, III 1979 11 p refs Presented at 2d Intern. Conf. on Energy Use Management, Los Angeles, 22-26 Oct. 1979
(Contract W-31-109-eng-38)
(CONF-791009-19) Avail: NTIS HC A02/MF A01

Four alternative alcohol fuel utilization scenarios are described. The development of the utilization scenarios was based on an evaluation of a broad range of implementation constraints and considerations. The final set of utilization scenarios will be used in the environmental assessment to bracket the probable environmental impacts and implications during the foreseeable future. DOE

N80-23478# Brookhaven National Lab., Upton, N. Y.
HYDROGEN STORAGE MATERIALS RESEARCH AND DEVELOPMENT WORK AT BROOKHAVEN NATIONAL LABORATORY
John R. Johnson 1979 4 p refs Presented at the DOE Chem. Energy Storage and Hydrogen Energy Systems Contracts Rev. Meeting, Reston, Va., 12 Nov. 1979
(Contract EY-76-C-02-0016)
(BNL-26813; CONF-791127-2) Avail: NTIS HC A02/MF QA01

The utilization of TiCr2 intermetallics (parent compounds or substituted systems) as energy storage media or for nonmechanical compression/liquefaction applications is discussed. Preliminary research into the feasibility of hydrogen separation from mixed gas streams, using intermetallic compounds, is briefly reported. DOE

N80-23479# California Univ., Livermore. Lawrence Livermore Lab.
PERFORMANCE AND PROPERTIES OF EXTRUSION CAST EXPLOSIVES COMPOSED OF HMX, FEFO AND AFNOL
John S. Hallam Oct. 1979 38 p refs
(Contract W-7405-eng-48)
(UCID-18633) Avail: NTIS HC A03/MF A01

The results of a comprehensive program to develop a series of extrusion cast explosives (ECX) are developed composed of HMX and AFNOL, an energetic, cast curable binder that is plasticized with FEFO. Results indicate that an ECX can be extruded into containers of almost any configuration and then cured in place without any shrinkage or loss of homogeneity. The results also show that in the cured state ECXs are extremely insensitive to impact, and their composition can be adjusted to give different energies; a formulation containing 80 wt % HMX has the equivalent energy of PBX 9404. DOE

N80-23480# Sandia Labs., Albuquerque, N. Mex.
INITIATION OF GRANULAR EXPLOSIVES BY RAMP WAVES
R. E. Setchell 1979 22 p refs Presented at the CPIA-JANNAF Combust. Conf., Monterey, Calif., 10 Sep. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1169C; CONF-790975-5) Avail: NTIS HC A02/MF A01

Initiation processes in granular explosives experiencing finite-risetime loading, in contrast to shock loading were investigated. Ramp waves having a risetime of either 0.3 microseconds or 0.8 microseconds were transmitted into the explosive PBX-9404, resulting in initial waves having a peak axial stress of 5.1 GPa. The incident waves were generated in discs of a glass-ceramic, pyroceram, by planar impact of copper-faced projectiles using a gas-fired gun facility. Velocity interferometry (VISAR) was used to measure particle velocity histories after the initial wave had propagated through explosive samples having different thicknesses. For comparison, similar measurements were made for the case of shock loading to the same initial peak stress. The slower-rising ramp wave initially loads the explosive at an average rate of 7 GPa microseconds. The VISAR measurements show that initiation processes leading to detonation are strongly inhibited at such a rate of compression. DOE

N80-23481# Battelle Columbus Labs., Ohio.
CARBOHYDRATE CROPS AS A RENEWABLE RESOURCE FOR FUELS PRODUCTION. VOLUME 1: AGRICULTURAL RESEARCH
E. S. Lipinsky, D. R. Jackson, S. Kresovich, M. F. Arthur, and W. T. Lawhon 15 May 1979 94 p refs
(Contract W-7405-eng-92)
(BMI-2031-Vol-1) Avail: NTIS HC A05/MF A01

Narrow row spacing of sweet sorghum and sugarcane as a means of reducing costs and increasing availability in selected geographical areas was emphasized. The influence of row spacing, cultivar selection, and planting date on yield and composition of sweet sorghum were evaluated in a typical corn belt state (Ohio). Similar data were obtained for Texas, Louisiana, Mississippi, and Florida for sweet sorghum and sugarcane. DOE

N80-23482# Lehigh Univ., Bethlehem, Pa. Center for Surface and Coatings Research.
METHANOL AND METHYL FUEL CATALYSTS Quarterly Report, Mar. - May 1979
Kamil Klier and Richard G. Herman Jun. 1979 14 p
(Contract ET-78-S-01-3177)
(FE-3177-3) Avail: NTIS HC A02/MF A01

Additional preparations of CuO/ZnO catalysts were made, and the materials were examined by X-ray powder diffractions. A series of cerium(IV) containing catalysts was prepared, and it was shown that the CuO/ZnO/CeO2 = 25/65/10 wt percent catalyst precursor contained the copper in the form of (Cu,Zn)2(OH)2CO3, analogous to the binary Cu/Zn = 30/70 sample. Calcination of this material, as well as of a binary ZnO/CeO2 = 87/13 sample, yielded oxides having small

crystallite sizes (< 135 Å). The reduced binary Cu/Zn catalysts were examined by diffuse reflectance spectroscopy and by X-ray powder diffraction. It was observed that the amount of noncrystalline copper assayed by X-ray diffraction correlated well with that found dissolved in the zinc oxide phase by an earlier scanning transmission electron microscopy study. The relationship between the optical parameters, such as the emergence of the high intensity visible absorption and the loss of the fundamental absorption edge of the zinc oxide, and the existence of the copper-zinc oxide solid solution were established. DOE

N80-23483# Institute of Gas Technology, Chicago, Ill.
DEVELOPMENT OF THE STEAM-IRON PROCESS FOR HYDROGEN PRODUCTION Quarterly Report, 1 Jul. - 30 Sep. 1978
Aug. 1979 95 p
(Contract EX-76-C-01-2435)
(FE-2435-39; QR-9) Avail: NTIS HC A05/MF A01

The data necessary for determining the effects of the major variables on hydrogen production in the steam-iron process were obtained. A number of significant milestones were achieved which furthered the development of the steam-iron process. A total of three highly successful hydrogen producing tests and data analysis for another test were completed. DOE

N80-23484# Bituminous Coal Research, Inc., Monroeville, Pa.
TEST AND EVALUATE THE TRI-GAS LOW-Btu COAL GASIFICATION PROCESS Quarterly Report, Apr. - Jun. 1979
Jul. 1979 38 p
(Contract ET-78-C-01-2798)
(FE-2798-66; BCR-L-1001) Avail: NTIS HC A03/MF A01

A total of three tests were conducted in the TRI-GAS PEDU. In the last two tests, the system was operated with the char and gas flows integrated in the process design mode. Smooth transfer of both char and gas between reactors was accomplished. Several minor equipment problems were encountered, but these will be alleviated through modifications. Work on the bench-scale equipment continued. DOE

N80-23485# Badger Plants, Inc., Cambridge, Mass.
CONCEPTUAL DESIGN OF A COAL-TO-METHANOL-TO-GASOLINE COMMERCIAL PLANT. VOLUME 3: ENVIRONMENTAL Interim Final Report, 31 Aug. 1977 - 1 Mar. 1979
Mar. 1979 216 p
(Contract EX-76-C-01-2416)
(FE-2416-43-Vol-3; IFR-2) Avail: NTIS HC A10/MF A01

The environmental considerations associated with an industrial manufacturing complex are addressed with specific reference to a coal-to-gasoline manufacturing facility. The environmental laws and regulations affecting the design of the coal-to-gasoline facility are summarized. Environmental control methods and equipment are outlined that will yield a zero plant discharge of all process waste water streams. Gaseous emissions are tabulated and methods of treatment and control are also described. Waste disposal by landfill methods are also considered. DOE

N80-23486# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL) Quarterly Progress Report, 1 Aug. - 31 Oct. 1979
Y. K. Ahn, Y. C. Chen, H. C. Chen, E. T. Nelson, R. P. Stringer, and Richard C. Bailie 1979 35 p refs Prepared in cooperation with West Virginia Univ., Morgantown, and Environmental Energy Engineering, Inc., Morgantown, W. Va.
(Contract ET-78-C-02-5022)
(COO-5022-9) Avail: NTIS HC A03/MF A01

Biomass characterization procedures were developed to characterize approximately 100 biomass species. Thermal gravimetric analyses were supplemented with a pyrogram and a pyrochromatogram to further characterize each biomass. Tests were run on the PDU in the fluidized bed mode to determine the effects of particle size on reaction time. Thirteen tests were run during this quarter to verify the results from previous testing. The process development unit was modified to accommodate future sustained runs. A mathematical model developed by modifying the Texaco entrained bed pilot plant gasifier model to simulate biomass gasification in an entrained bed. Results were evaluated. A biomass economic program was developed to provide average product fuel costs using 15 thermochemical processes. DOE

N80-23487# Gilbert Associates, Inc., Reading, Pa.
RESEARCH AND EVALUATION OF BIOMASS RESOURCES/CONVERSION/UTILIZATION SYSTEMS (MARKET/EXPERIMENTAL ANALYSIS FOR DEVELOPMENT OF A DATA BASE FOR A FUELS FROM BIOMASS MODEL)
R. P. Stringer and R. C. Bailie 1979 17 p Prepared in cooperation with West Virginia Univ., Morgantown, and Environmental Energy Engineering, Inc., Morgantown, W. Va.
(Contract ET-78-C-02-5022)
(COO-5022-8) Avail: NTIS HC A02/MF A01

A market analysis of the need for biomass derived fuels presented and the regional availability of biomass resources on seasonal bases are discussed. Biomass conversion profiles were developed for 100 biomass materials including wood species, bagasse, sugar cane, wheat and rice straw, corn stover, and others. Conversion profiles were developed from thermal gravimetric analyses runs under various conditions of temperature and pressure and in the presence of catalysts. Gasification, pyrolysis, and direct combustion were the modes of conversion. An attempt was made to develop biomass-to-fuel process models and to verify them using process development unit runs. Finally, a linear programming model was developed for selecting the most profitable combination of feedstocks and the conversion processes required to satisfy fuels need under given market conditions. The data banks of market conditions for biomass resources and biomass derived fuels, biomass conversion profiles, and commercial scale process economics were used as input to the model. DOE

N80-23488# Los Alamos Scientific Lab., N. Mex.
EXPLOSIVES RESEARCH AND DEVELOPMENT: RECOMMENDATIONS AND COMMENTS ON UNSOLVED PROBLEMS
Louis C. Smith Nov. 1979 46 p refs
(Contract W-7405-eng-36)
(LA-8124-MS) Avail: NTIS HC A03/MF A01

Historical highlights and the current status of the science of high explosives are briefly reviewed, and recommendations and comments on areas deserving special attention during the next decade or so are offered. DOE

N80-23489# SRI International Corp., Menlo Park, Calif.
FRACTURE AND FRAGMENTATION OF HIGH ENERGY PROPELLANT Annual Report
W. J. Murri, Y. M. Gupta, and D. R. Curran Apr. 1979 48 p refs
(Contracts W-7405-eng-48; E(04-3)-115; SRI Proj. PYU-5532)
(UCRL-15160) Avail: NTIS HC A03/MF A01

Dynamic fracture and fragmentation of VRA high energy propellant were investigated. A predictive model for fracture, and fragmentation and associated formation of surface area during dynamic loading was developed. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N80-23490 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 9
Judith Nagle-Eshleman, ed. Sep. 1979 113 p refs
(AD-A074320) Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Techniques and applications of mechanical signature analysis are examined with a specific emphasis on monitoring the condition of rotating machinery. Also, the frictional damping

mechanisms that can occur in structural joints are discussed. An abstract bibliography of current literature is included. For individual titles, see N80-23491 through N80-23492.

N80-23491 Shock and Vibration Information Center (Defense), Washington, D. C.
TECHNIQUES AND APPLICATIONS OF MECHANICAL SIGNATURE ANALYSIS c37
R. H. Volin *In its* The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 17-33 refs (For primary document see N80-23490 14-31)
Avail: NRL Code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Techniques and applications of mechanical signature analysis are examined with a particular emphasis on monitoring the condition of rotating machinery. Vibration signature standard and comparative criteria, measurement and instrumentation, and data analysis are addressed. Condition assessment of gears, pumps, valves, and ground vehicles are also specifically discussed. M.G.

N80-23492 Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
DAMPING IN STRUCTURAL JOINTS c39
C. F. Beards *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 35-41 refs (For primary document see N80-23490 14-31)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

The frictional damping mechanisms that can occur in structural joints are discussed. Linearized theories appear adequate for describing the macroslip range. Optimum joint clamping forces exist for maximum energy dissipation and for minimum structural response and have been experimentally confirmed. Fretting corrosion can be controlled by hardening joint interfaces or using EDM joints. It is suggested that some joints in any structure could allow slight slip without affecting the integrity of the structure, thereby increasing inherent damping and improving vibrational performance. Author

N80-23493 Toledo Univ., Ohio.
BAYESIAN CONCEPTS FOR RELIABILITY AND STATISTICAL DECISION THEORY FOR STRUCTURAL DESIGN Ph.D. Thesis
Hikmat F. Mahmood 1977 163 p
Avail: Univ. Microfilms Order No. 8010799

A design procedure based on subjective analysis is developed to overcome the lack of information in the design practice. Methods of prediction are presented which are based on information collected about the specific structure to be designed or similar structures. These predictions are described by a likelihood measure. Bayes' theorem provides a formal method of revising probability measures as new information becomes available. The application of Bayesian methods to structural design problems, where there are limited experimental data, is described. Also, theoretical models are developed for structural designs based on the information available about the design variables. An a priori distribution is used to present prior knowledge or relative ignorance. Earthquake data of ground accelerations is presented and a method for predicting future earthquake accelerations is discussed as an application of this technique. Then, based on this information, a frame structure is analyzed and the probability of occurrence of such earthquakes is included. Dissert. Abstr.

N80-23494 Akron Univ., Ohio.
PROGRESSIVE SETTLEMENTS OF FOUNDATIONS ON COHESIONLESS SOILS SUBJECTED TO VERTICAL VIBRATORY LOADINGS Ph.D. Thesis
Soppetch Leelanitkul 1980 121 p
Avail: Univ. Microfilms Order No. 8010682

A governing equation was developed to relate with existing dynamic soil constitutive relationships. A method for progressive settlement analysis was then developed in which the shearing strain amplitude and number of loading cycles was related to the progressive strain. Comparisons of progressive strains observed from different types of dynamic tests at the same shearing strain amplitude show consistency of the method. The procedure and relationships can be used for predicting the progressive settlement of dynamically loaded foundations. An examination of a model test reported in the literature demonstrates the applicability of the developed method. Dissert. Abstr.

N80-23495*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROCEEDINGS OF THE 14TH AEROSPACE MECHANISMS SYMPOSIUM
May 1980 327 p refs Symp. held at Hampton, Va., 1-2 May 1980; sponsored in part by Calif. Inst. of Tech. and Lockheed Missiles and Space Co.
(NASA-CP-2127; L-13610) Avail: NTIS HC A15/MF A01 CSCL 20K

Technological areas covered include aviation propulsion, aerodynamic devices, and crew safety; space vehicle propulsion, guidance and control; spacecraft deployment, positioning, and pointing; spacecraft bearings, gimbals, and lubricants; and large space structures. Devices for payload deployment, payload retention, and crew extravehicular activity on the space shuttle orbiter are also described. For individual titles, see N80-10248 through N80-10274. For individual titles, see N80-23496 through N80-23522.

N80-23496*# Boeing Aerospace Co., Seattle, Wash.
MECHANISMS TO DEPLOY THE TWO-STAGE IUS FROM THE SHUTTLE CARGO BAY c18
H. Theron Haynie *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 1-8 ref (For primary document see N80-23495 14-31)
(Contract F04701-78-C-0040)
Avail: NTIS HC A15/MF A01 CSCL 22B

The Inertial Upper Stage (IUS) is a two-stage or three-stage booster used to transport spacecraft from the space shuttle orbit to synchronous orbit or on an interplanetary trajectory. The mechanisms which were designed specifically to perform the two-stage IUS required functions while contained within the cargo bay of the space shuttle during the boost phase and while in a low Earth orbit are discussed. The requirements, configuration, and operation of the mechanisms are described, with particular emphasis on the tilt actuator and the mechanism for decoupling the actuators during boost to eliminate redundant load paths. R.E.S.

N80-23497*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MANNED MANEUVERING UNIT LATCHING MECHANISM c54
Charles S. Allton *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 9-18 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 05H

The astronaut/Manned Maneuvering Unit interface, which presented a challenging set of requirements for a latching mechanism, is described. A spring loaded cam segment with variable ratio pulley release actuator was developed to meet the requirements. To preclude jamming of the mechanism, special precautions were taken such as spring loaded bearing points and careful selection of materials to resist cold welding. The mechanism successfully passed a number of tests which partially simulated orbital conditions. R.E.S.

N80-23498*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER DOOR CLOSURE TOOLS c37
William R. Acres *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 19-31 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

Safe reentry of the shuttle orbiter requires that the payload bay doors be closed and securely latched. Since a malfunction in the door drive or bulkhead latch systems could make safe reentry impossible, the requirement to provide tools to manually close and secure the doors was implemented. The tools would disconnect a disabled door or latch closure system and close and secure the doors if the normal system failed. The tools required to perform these tasks have evolved into a set that consists of a tubing cutter, a winch, a latching tool, and a bolt extractor. The design, fabrication, and performance tests of each tool are described. R.E.S.

N80-23499*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER EMERGENCY CREW ESCAPE SYSTEM c03
William W. Lofland *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 33-46 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 22B

Two conventional ejection seats were incorporated into the first two orbiter vehicles to provide the crew with emergency ejection capability during the flight test programs. To avoid extensive development and test costs, existing ejection seats were selected and minimum modifications were made to accommodate the orbiter application. The new components and modifications were qualified at the component level, and a minimum sled test program was conducted to verify the orbiter installation and validate the six degree-of-freedom analysis. The system performance was certified and the orbital flight test capability was established by analysis. R.E.S.

N80-23500*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLUID CIRCULATING PUMP OPERATED BY SAME INCIDENT SOLAR ENERGY WHICH HEATS ENERGY COLLECTION FLUID c37
Earl R. Collins *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 47-56 refs (For primary document see N80-23495 14-31)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 13K

The application of using a spacecraft solar powered pump terrestrially to reduce or eliminate the need for fossil fuel generated electricity for domestic solar hot water systems was investigated. A breadboard prototype model was constructed utilizing bimetals to convert thermal energy into mechanical motion by means of a toggle operated shutter mechanism. Although it did not meet expected thermal efficiency, the prototype model was sufficient to demonstrate the mechanical concept. R.E.S.

N80-23501*# Vought Corp., Dallas, Tex.
THE ECCENTUATOR: A NEW CONCEPT IN ACTUATION c37
Robert G. Musgrove *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 57-67 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A new concept in actuation for aerospace mechanisms is presented. This actuator, called an 'eccentuator', features unique output characteristics, installation and envelope efficiencies, and relative simplicity. The actuator can be powered by either hydraulic or mechanical inputs. Potential applications of the 'eccentuator' and development efforts are discussed. R.E.S.

N80-23502*# Institute for Industrial Research and Standards, Dublin (Ireland).
THE ACTUATED LATCH PIN AND ITS DEVELOPMENT c37
Patrick J. Lawlor *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 69-78 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

An actuated latch pin developed to meet the need for a reusable locking device is described. The unit can function as a pin puller or as a pin pusher latch. Initial prototype testing demonstrated the feasibility of the device with the unit being driven from a 28 V dc supply and using 15 W to drive a 12 mm diameter pin through a stroke of 10 mm with a side load of 100 N in 120 ms. High wear rates with a MOS2 lubrication on the ballscrew and angular contact bearings have necessitated the reduction in the duty cycle from 1000 cycles in air and vacuum to 100 in air and 1000 in vacuum. M.G.

N80-23503*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
BALL BEARING VERSUS MAGNETIC BEARING REACTION AND MOMENTUM WHEELS AS MOMENTUM ACTUATORS c37
W. Auer *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 79-91 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

Different bearing technologies of momentum actuators for the attitude control of satellites are compared and a guideline for the selection of the suitable momentum actuators or momentum actuator configurations to meet given mission goals with high reliability and low cost is developed. The comparison between ball bearing and magnetic bearing momentum actuators shows that given mission requirements can be economically met by employing the ball bearing technology without decreasing reliability and lifetime. However, for some special mission requirements, such as 'zero friction at zero speed,' fine pointing (met by vernier gimballing), and/or active damping, magnetic bearings may be advantageous. This makes it evident that magnetic bearing technology will not replace ball bearing technology for momentum actuators, but will supplement it for some special mission requirements. M.G.

N80-23504*# Societe Nationale Industrielle Aerospatiale, Paris (France).
CENTRIFUGAL REGULATOR FOR CONTROL OF DEPLOYMENT RATES OF DEPLOYABLE ELEMENTS c37
J. C. Vermalle *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 93-99 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The requirements, design, and performance of a centrifugal regulator aimed at limiting deployment rates of deployable elements are discussed. The overall mechanism is comprised of four distinct functional parts in a machined housing: (1) the centrifugal brake device, which checks the payout of a deployment cable; (2) the reducing gear, which produces the spin rate necesary for the braking device; (3) the payout device, which allows the unwinding of the cable; and (4) the locking device, which prevents untimely unwinding. The centrifugal regulator is set into operation by a threshold tension of the cable which unlocks the mechanism and allows unwinding. The pulley of the windout device drives the centrifugal brake with the help of the reducing gear. The centrifugal force pushes aside weights that produce friction of the studs in a cylindrical housing. The mechanism behaved well at qualification temperature and vibrations. M.G.

N80-23505*# Science Research Council, Chilton (England).
MECHANISMS OF UK RADIOMETERS FLOWN ON NIMBUS 5 AND 6 WITH PARTICULAR REFERENCE TO BEARINGS, PIVOTS AND LUBRICATION c37
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 101-110 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The mechanisms incorporated in the vertical sounding infrared radiometry experiments which were launched on Nimbus 5 in 1972 and on Nimbus 6 in 1975 are discussed. Both use dry lubricants. The Nimbus 5 radiometer includes a rotating chopper driven via a carbon fiber-acetal resin gearwheel. The driving motor runs at 2000 rpm and has completed over 7 x 10 to the 9th power revolutions. Four gear driven filter wheels powered by stepper motors have each completed 2 x 10 to the 8th power changes. The input calibration mirror mechanism and its field of view compensation mechanisms are also described. All 25 ball races used in the experiment are of the film transfer type. The Nimbus 6 radiometer includes two cells. Each contains a piston supported on diaphragm springs and driven electromagnetically. The pistons are 6 cm in diameter with a stroke of 1 cm and are driven at their mechanical resonant frequency of approx. 15 Hz. The calibrating mirrors rotate periodically to view a target. The support pivots are synthetic sapphire ring stones with separate end thrust stones. The problems of mounting these stones to withstand vibration loads is described. M.G.

N80-23506*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRIPLE-AXIS COMMON-PIVOT ARM WRIST DEVICE FOR MANIPULATIVE APPLICATIONS c37
Leendert Kersten and J. Dwight Johnston *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 111-124 ref Prepared in cooperation with Nebraska Univ.-Lincoln (For primary document see N80-23495 14-31)

Avail: NTIS HC A15/MF A01 CSCL 13I

A concept in manipulator development to overcome the 'weak wrist syndrome', a triple-axis common-pivot arm wrist (TACPAW), is presented. It contains torque motors for actuation, tachometers for measuring rate, and resolvers for position measurements. Furthermore, it provides three degrees of freedom, i.e., pitch, yaw, and roll, in a single manipulator joint. The advantages of this development are increased strength, compactness, and simplification of controls. Designed to be compatible with the prototflight manipulator arm, the joints of TACPAW are back-drivesable with + or - 45 deg rotation in pitch, + or - 45 deg in yaw and continuous roll in either direction while delivering 20.5 N-m (15 ft-lb) torque in each of the three movements. M.G.

N80-23507*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DESIGN AND DEVELOPMENT OF THE QUAD REDUNDANT SERVOACTUATOR FOR THE SPACE SHUTTLE SOLID ROCKET BOOSTER THRUST VECTOR CONTROL c20
James M. Lominick *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 125-141 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 21H

The design and theory of operation of the servoactuator used for thrust vector control of the space shuttle solid rocket booster is described accompanied by highlights from the development and qualification test programs. Specific details are presented concerning major anomalies that occurred during the test programs and the corrective courses of action pursued. M.G.

N80-23508*# Rockwell International Corp., Seal Beach, Calif. Space Systems Group.
A PRECISION BEARING GIMBAL SYSTEM FOR THE TEAL RUBY PROGRAM c37
Charles H. Lowry *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 143-153 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A precision bearing gimbal system designed to allow a spaceborne infrared sensor to stare at points on the Earth while in orbit is described. The problems encountered, analytical tools and test methods used, and data applicable to users of similar systems are presented. Assembly procedures, bearing preload effects, moisture control, structural analysis, and noise control are specifically examined. M.G.

N80-23509*# General Dynamics/Convair, San Diego, Calif.
FUEL/HYDRAULIC TRANSFER VALVE IMPROVES RELIABILITY OF ATLAS SPACE LAUNCH VEHICLE c37
M. Ogman *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 155-161 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13K

The Atlas fuel hydraulic transfer valve design is described. The design satisfies primary goals such as fuel and oil isolation before launch in order to use existing ground support and airborne hardware and procedures. The valve operates only after the vehicle has been committed to launch. Hydraulic system function is maintained if the valve fails to function. Valve operation is mechanical and interfaces only with the propulsion system. R.C.T.

N80-23510*# Hughes Aircraft Co., Culver City, Calif.
KU BAND DEPLOYED ASSEMBLY AND GIMBAL c37
T. E. Deal *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 163-172 Sponsored in part by Rockwell International Corp. (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

Requirements for shuttle orbiter missions to locate satellites for servicing and to communicate when out of touch with a direct ground link were established. A Ku Band deployed antenna system providing an integrated radar and communications function was designed to meet these requirements. The unique features of the gimbal assembly are described with emphasis on the following: edge mounted antenna to minimize stowage volume in shuttle and maximize gain; unique two axis housing and shaft arrangement to accommodate two runs of waveguide and 55 electrical conductors without requiring slip rings; maximum use of aluminum in gimbal structure to reduce costs; and lubricant chosen to survive Earth and space environments. R.C.T.

N80-23511*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EMERGENCY IN-FLIGHT EGRESS OPENING FOR GENERAL AVIATION AIRCRAFT c03
Laurence J. Bement *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 173-194 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

An emergency in-flight egress system was installed in a light general aviation airplane. The airplane had no provision for egress on the left side. To avoid a major structural redesign for a mechanical door, an add on 11.2 kg (24.6 lb) pyrotechnic-actuated system was developed to create an opening in the existing structure. The skin of the airplane was explosively severed around the side window, across a central stringer, and down to the floor, creating an opening of approximately 76 by 76 cm. The severed panel was jettisoned at an initial velocity of approximately 13.7 m/sec. System development included a total of 68 explosive severance tests on aluminum material using small samples, small and full scale flat panel aircraft structural mockups, and an actual aircraft fuselage. These tests proved explosive sizing/severance margins, explosive initiation, explosive product containment, and system dynamics. This technology is applicable to any aircraft of similar construction. R.C.T.

N80-23512*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A SPIN-RECOVERY PARACHUTE SYSTEM FOR LIGHT GENERAL-AVIATION AIRPLANES c08
Charles F. Bradshaw *In its* Proc. of the 14th Aerospace Mech. Symp. May 1980 p 195-209 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

A tail mounted spin recovery parachute system was designed and developed for use on light general aviation airplanes. The system was designed for use on typical airplane configurations, including low wing, high wing, single engine and twin engine designs. A mechanically triggered pyrotechnic slug gun is used to forcibly deploy a pilot parachute which extracts a bag that deploys a ring slot spin recovery parachute. The total system weighs 8.2 kg. System design factors included airplane wake effects on parachute deployment, prevention of premature parachute deployment, positive parachute jettison, compact size, low weight, system reliability, and pilot and ground crew safety. Extensive ground tests were conducted to qualify the system. The recovery parachute was used successfully in flight 17 times. R.C.T.

N80-23513*# Pratt and Whitney Aircraft, East Hartford, Conn. Government Products Div.
F100 EXHAUST NOZZLE AREA CONTROL c07
Joseph R. Kozlin *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 211-223 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 21E

The details of the F100 nozzle mechanism design are highlighted, placing particular emphasis upon the evolution of design constraints or drivers from initial concept through current operational deployment. A kinematic description of the area control mechanism is given, and several environmental constraints which complicate the normal mechanism design process are discussed. R.C.T.

N80-23514*# Boeing Commercial Airplane Co., Seattle, Wash.
AIRPLANE WING LEADING EDGE VARIABLE CAMBER FLAP c05
James B. Cole *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 225-235 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 01C

The invention and design of an aerodynamic high lift device which provided a solution to an aircraft performance problem are described. The performance problem of converting a high

speed cruise airfoil into a low speed aerodynamic shape that would provide landing and take-off characteristics superior to those available with contemporary high lift devices are addressed. The need for an improved wing leading edge device that would complement the high lift performance of a triple slotted trailing edge flap is examined. The mechanical and structural aspects of the variable camber flap are discussed and the aerodynamic performance aspects only as they relate to the invention and design of the device are presented. R.C.T.

N80-23515*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
A MECHANICAL ADAPTER FOR INSTALLING MISSION EQUIPMENT ON LARGE SPACE STRUCTURES c37
A. LeFever and R. S. Totah *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 237-245 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A mechanical attachment adapter was designed, constructed, and tested. The adapter was was included in a simulation program that investigated techniques for assembling erectable structures under simulated zero-g conditions by pressure-suited subjects in a simulated EVA mode. The adapter was utilized as an interface attachment between a simulated equipment module and one node point of a tetrahedral structural cell. The mating performance of the adapter, a self-energized mechanism, was easily and quickly demonstrated and required little effort on the part of the test subjects. R.C.T.

N80-23516*# Grumman Aerospace Corp., Bethpage, N.Y.
AUTOMATED BEAM BUILDER c37
Walter K. Muench *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 247-265 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

Requirements for the space fabrication of large space structures are considered with emphasis on the design, development, manufacture, and testing of a machine which automatically produces a basic building block aluminum beam. Particular problems discussed include those associated with beam cap forming; brace storage, dispensing, and transporting; beam component fastening; and beam cut-off. Various critical process tests conducted to develop technology for a machine to produce composite beams are also discussed. A.R.H.

N80-23517*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE MAGSAT MAGNETOMETER BOOM c37
James F. Smola, Wade E. Radford, and Marcus H. Reitz *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 267-278 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

A lightweight extendable structure that can precisely position magnetically sensitive instruments safe distances from magnetic sources in a spacecraft is described as well as the major areas of concern that played dominant roles in its development. Weight, packaging volume, thermal distortion, mechanical misalignments, dimensional instability, launch environments, and low temperature functioning were areas that presented some formidable obstacles. The ways in which these obstacles were dealt with are examined for those involving the development of similar aerospace mechanisms with equally restrictive requirements. A.R.H.

N80-23518*# General Electric Co., Philadelphia, Pa. Reentry Systems Div.
DRAWER DRIVE FOR SPACE SHUTTLE VACUUM CANISTER c37
Kenneth E. Werner *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 279-288 (For primary document see N80-23495 14-31)
(Contract NAS1-14375)
Avail: NTIS HC A15/MF A01 CSCL 13I

A sliding drawer type canister was designed to contain long duration exposure facility experiments which require vacuum storage before and after space exposure. The elastomeric seals require high closing loads which are generated through camming levers and transmitted through a spring loaded pressure plate. Lubrication was provided by various dry surface coatings. Higher than expected friction required some redesign after which the assembly functioned well and provided good sealing. Author

N80-23519*# Santa Barbara Research Center, Goleta, Calif.
DESIGN OF AN ATMOSPHERIC SOUNDING RADIOMETER FOR THE GOES METEOROLOGICAL SATELLITE SYSTEM c47
Robert G. Jensen *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 289-301 (For primary document see N80-23495 14-31)
(Contracts NAS5-21139; NAS5-20769)
Avail: NTIS HC A15/MF A01 CSCL 04B

An advanced version of the visible infrared spin scan radiometer onboard U.S. geostationary operational environmental satellites was developed to add a vertical dimension to the instrument's infrared atmospheric images. Through the addition of twelve selectable narrow band filters and more precise in-flight calibration of the infrared detectors, the VISSR atmospheric sounder (VAS) will provide increased data to help determine the Earth's atmospheric temperature and water vapor distribution. The radiometer design, filter wheel, calibration shutter mechanisms, and their preflight test performance are discussed. A.R.H.

N80-23520*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A POLARIMETER FOR THE HIGH RESOLUTION ULTRAVIOLET SPECTROMETER/POLARIMETER c35
John A. Calvert *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 303-310 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 14B

The design requirements of the polarimeter were established by the scientific optical objectives of the experiment to be launched aboard the Solar Max Mission which will study active solar regions. The polarization of the light is accomplished by a rotating magnesium fluoride quarter wave plate. The quarter wave plates are rotated in 22 1/2 degree steps about an axis coincidental with the light beam. As the light beam passes through the wave plate, the transformation that occurs can be expressed by mathematical equations. By having the wave plates calibrated, the data obtained from solar flares can be analyzed and meaningful information provided to the investigators. The polarimeter has two wave plates with different optical characteristics to provide both redundancy and versatility. A four mirror polarizer was added behind one wave plate to provide additional polarization. The mechanical design, testing, and operation of the polarimeter for the high resolution ultraviolet spectrometer/polarimeter are described. A.R.H.

N80-23521*# Ford Aerospace and Communications Corp., Newport Beach, Calif.
THE DESIGN AND APPLICATION OF AN ANTENNA POSITIONER MECHANISM FOR INTELSAT-5 SERIES COMMUNICATION SATELLITE c37
Big Szeto *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 311-322 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

In opertion, the East/West spot beam reflectors on the Intelsat-5 series communication satellite are required to satisfy initial precise-pointing to particular Earth locations; and repositioning and pointing to different Earth locations as traffic changes dictate during the seven year mission. Two 2 axis antenna positioner mechanisms (APM) are utiltized in fulfilling these requirements. Each APM is comprised of three components which consist of one center pivot and two linear actuators rather than an integral two axis gimbal design. The step resolution of the APM can be adjusted as required with the present design, at a step resolution of 0.002865 degrees. The design philosophy and considerations, test program, and test results are discussed as well as some major problems encountered during the course of testing and their resolution. A.R.H.

N80-23522*# Science Research Council, Chilton (England).
THE MECHANISMS OF THE SAMS EXPERIMENT FLOWN

ON NIMBUS 7 WITH PARTICULAR REFERENCE TO THE 2 AXIS SCANNING MIRROR c37
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 323-333 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

The stratospheric and mesospheric sounder (SAMS) experiment on Nimbus 7 includes a 2 axis scanning mirror and 7 pressure modulator cells. The SAMS experiment is a limb sounding instrument to measure the temperature profile and minor constituents of the atmosphere. The limb scan requires small mirror steps over a 3 deg range, while the scan in azimuth is in larger steps over a 15 deg range. The mirror is plane, 20 cm in diameter, and of zero expansion glass-ceramic. It is supported on two tilt tables, fitted one on the other, with the axes at right angles. The angle of tilt is adjusted by means of recirculating ball screws which are ion plated with lead for lubrication and driven by stepper motors. The seven gas filled cells are each pressure modulated by a 3 cm diameter, 0.3 cm stroke piston which is supported by diaphragm springs and driven electromagnetically at the system's mechanical resonant frequency. The mean pressure of the filling gas, which is the atmospheric constituent being measured, is changed by varying the temperature of a suitable molecular sieve. Author

N80-23523# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
A NEW METHOD OF ROUNDNESS MEASUREMENT BY CAPACITIVE DETECTORS Thesis - Paris VI Univ.
Bernard Foulon 1979 86 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-635)
(ONERA-NT-1979-9; ISSN-0078-3781) Avail: NTIS HC A05/MF A01

A high precision technique for roundness measurements of nearly cylindrical mechanical parts by the use of capacitive detectors was developed. The general problems encountered in roundness measurements and the limitations of existing systems are presented. The apparatus and test results are described. A 3 mm radius cylinder was measured with a relative accuracy of 0.0001. Theoretically the method makes it possible to determine the exact roundness of an unknown section. Author (ESA)

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N80-23524* National Aeronautics and Space Administration. Pasadena Office, Calif.
DUAL BAND COMBINER FOR HORN ANTENNA Patent
William F. Williams (JPL) and Seymour B. Cohn, inventors (to NASA) (JPL) Issued 22 Apr. 1980 5 p Filed 31 Jan. 1979 Supersedes N79-17068 (17 - 08, p 0968) Sponsored by NASA
(NASA-Case-NPO-14519-1; US-Patent-4,199,764; US-Patent-Appl-SN-008207; US-Patent-Class-343-786; US-Patent-Class-343-895) Avail: US Patent and Trademark Office CSCL 17B

A corrugated horn antenna, adapted to be coupled to a waveguide at its apex for X-band excitation is further adapted to be connected to waveguides through a circumferential slot for S-band excitation at four distinct phases selected for the desired S-band polarization. The circumferential slot is positioned along the axial length of the horn for good impedance matching and is provided with an X-band choke in the form of two concentric choke slots. For further improvement in impedance matching, the second (outer) choke slot is divided by plugs into four segments that coincide with waveguide ports for the four distinct phases of the S-band.

Official Gazette of the U.S. Patent and Trademark Office

N80-23525 Rensselaer Polytechnic Inst., Troy, N. Y.
SIGNAL PROCESSING USING SURFACE ACOUSTIC WAVE DEVICES Ph.D. Thesis
Duane Roger Arsenault 1979 596 p
Avail: Univ. Microfilms Order No. 8011495

Three surface acoustic wave (SAW) devices, the separated medium convolver, the memory correlator, and the chirp filter are analyzed for signal processing applications. Emphasis is placed on convolution/correlation and Fourier transformation processes. The chirp filter theory is more general and applies equally well to chirp filters fabricated by alternate techniques. Dissert. Abstr.

N80-23526 Mississippi Univ., University.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF PLANAR DISCONTINUITIES IN COAXIAL WAVEGUIDES Ph.D. Thesis
Michael George Harrison 1979 233 p
Avail: Univ. Microfilms Order No. 8011143

An integral equation approach is developed for treating a large class of planar discontinuities in coaxial waveguides. The technique can effectively treat single and multiple discontinuities with no constraints on frequency or relative location. The integral equations are formulated with the transverse component of electric field in the aperture of each discontinuity as the unknown quantity. A numerical solution procedure is described which allows a choice of both the number of sub-sectional expansion pulses employed in each aperture and the number of terms evaluated in the modified higher-order-mode series. Once a solution for the electric field in each aperature is obtained, straight-forward procedures may be employed to compute the admittance of any discontinuity or the field anywhere in the waveguige. Two sets of coaxial waveguide/cavity structures were constructed and an extensive program of experimental measurements of cavity admittance and field components at cavity wall was pursued. The measured results are compared to integral equation calculations of the same quantities to verify the accuracy of the approach. Dissert. Abstr.

N80-23527 Mississippi Univ., University.
ELECTROMAGNETIC PENETRATION THROUGH A SLOT IN A SCREEN COVERED BY A DIELECTRIC SLAB Ph.D. Thesis
Robert Dudley Nevels, Jr. 1979 181 p
Avail: Univ. Microfilms Order No. 8011149

The problem of scattering from a slot in a screen covered by a dielectric slab is discussed in terms of its applications in the study of electromagnetic pulse effects as well as the analysis of transmission and reception through apertures located on the surfaces of aircraft. Integral equations are derived in terms of the tangential electric field in the slot for an electromagnetic wave incident upon a simple slot, coupled slots and a notch in a ground screen covered by a dielectric slab. The method of moments is used to solve the various coupled integral equations derived. Results are presented for the electric field in a slot lying in a dielectric covered ground screen as a function of slot width and dielectric thickness. For the problem of multiple slots in a ground screen covered by a pielectric slab, results are given for the electric field in the slot as function of slot width, dielectric thickness and spacing between the slots. The electric field in the aperture of a notch in a ground screen covered by a dielectric slab is presented as a function of the width, dielectric thickness and notch depth. Other pertinent results are reported. Dissert. Abstr.

N80-23528 California Univ., San Diego.
PROBE SIGNALING ON FADING MULTIPATH COMMUNICATION CHANNELS Ph.D. Thesis
Lawrence Elvin Hoff 1979 259 p
Avail: Univ. Microfilms Order No. 8009753

The application of forward probe signaling to unknown, randomly fading multipath communication channels is explained. The essence of the probe concept is that by dedicating part of the transmitted energy to channel probing, the receiver can measure the channel response and then construct an optimum detection scheme for the information waveform. It is shown that the detection efficiency is improved more than enough to compensate for the energy required by the probe measurements. For highly dispersed channels, the probed signaling technique

can reduce the required signal to noise ratio by 10 to 20 dB over unprobed schemes at 0.0001 bit error rate. A mathematical model of the communication problem is given. Dissert. Abstr.

N80-23529 Texas Univ. at Dallas, Richardson.
ATTENUATION OF TELESEISMIC P-WAVES WITHIN GEOTHERMAL SYSTEMS Ph.D. Thesis
Chi-Yuh Young 1979 202 p
Avail: Univ. Microfilms Order No. 8010654

A technique was developed to quantitatively construct a crystal Q model. The reduced spectral ratio method was used to compare the power density spectra of the teleseismic P-wave seismograms and calculated the lateral variation of the differential attenuation factor delta t for each station deployed across the surface of a geothermal area. These data were inverted using a generalized discrete linear inversion technique to construct a quality factor, Q, model of the crust for the geothermal system. The inaccuracies of the inversion result were due to the effect of the observational errors and necessary simplification in applying the method. An empirical relationship was determined between the error involved in the observed diffential attenuation factor and the inversion results. It indicated that when the signal to error ratio is above 5, the original model is reproducible, between 5 and 1, there is a dramatic degradation of fidelity and at 1 or below, numerous low Q cells are indentified as high Q and vice versa. Dissert. Abstr.

N80-23530# National Aviation Facilities Experimental Center, Atlantic City, N. J.
MEASUREMENT OF INTERFERENCE-TO-NAVIGATION/COMMUNICATION AVIONICS FROM CABLE TELEVISION (CATV) SYSTEMS Final Report, Jan. - Sep. 1978
Edward M. Sawtelle and James G. Dong Dec. 1979 52 p refs
(FAA Proj. 213-662-810)
(AD-A081430; FAA-NA-79-7; FAA-RD-79-104) Avail: NTIS HC A04/MF A01 CSCL 20/14

Airborne measurements of cable television (CATV) leakage, made at selected cities to compile a representative sampling of interference effects are presented and discussed. Different altitudes were used in the flight-grid-type pattern. Ground measurements were also accomplished by the Federal Communications Commission (FCC) at the sites tested to determine any correlation between the ground and air measurements. The cities selected for discussion in this report were chosen to show various CATV effects detected by the data collection systems. A statistical analysis was performed on the data upon finding that direct airborne position correlation to strong ground leak points was not possible. The analysis provided the mean for each run of a grid and a comparison to determine if significant differences existed between runs. Where no significant differences were found, the condition was due to ambient noise exceeding signal level. Laboratory measurements were also made. Recommendations include maximum signal level for CATV leakage that may be tolerated in the communication and navigation bands. A further recommendation is made that the CATV industry use frequencies in the navigation band which are separated from Federal Aviation Administration navigation frequencies by 25 kilohertz. M.G.

N80-23531*# Illinois Univ., Urbana. Aeronomy Lab.
THE URBANA COHERENT-SCATTER RADAR: SYNTHESIS AND FIRST RESULTS
K. P. Gibbs and S. A. Bowhill 1 Dec. 1979 98 p refs
(Grants NsG-7506; NSF ATM-78-15224)
(NASA-CR-153186; UILU-ENG-79-2509; Aeronomy-90; ISSN-0568-0581) Avail: NTIS HC A05/MF A01 CSCL 17I

A coherent scatter radar system was synthesized and several hundred hours of echo power and line of sight velocity data obtained. The coherent scatter radar utilizes a diode array and components from meteor radar. The receiving system permits a time resolution of one minute in the data. Echo power from the D region shows a high degree of variability from day to day. Examples of changes in power level at shorter time scales are observed. Velocity data show the existence of gravity waves and occasionally exhibit vertical standing wave characteristics. E.D.K.

N80-23532# Naval Ocean Systems Center, San Diego, Calif.
AEGIS SPY-1 RADAR 5-V/60-A SWITCHING-MODE POWER SUPPLY STABILITY ANALYSIS: A STABILITY ANALYSIS EMPLOYING STATE-SPACE AVERAGING TECHNIQUES FOR CONVERTER MODELING
R. E. Hammond Jan. 1979 47 p refs
(XF54582093)
(AD-A080449; NOSC/TR-363) Avail: NTIS HC A03/MF A01 CSCL 10/2

State of the art techniques for modeling switching regulator power supplies are applied to the AEGIS SPY-1 Radar 5-volt/60-ampere power supply. The results of the modeling and subsequent analysis are used to predict the power supply's basic stability and performance characteristics. GRA

N80-23533# Defence Research Establishment, Ottawa. (Ontario). Defense Electronics Div.
RADAR VIDEO PULSE RECORDING SYSTEM
Pierre B. Richer Sep. 1979 51 p
(AD-A081156; DREO-TN-79-19) Avail: NTIS HC A04/MF A01 CSCL 17/9

This technical note covers the design and development of an interface unit which was developed to enable a Sony TC-158SD audio cassette recorder to record and playback the pulse repetition frequency (PRF) of a video radar signal within the range of 100 to 5000 pps. GRA

N80-23534# Harry Diamond Labs., Adelphi, Md.
MODIFICATION OF THE AURORA ELECTROMAGNETIC ENVIRONMENT EXPERIMENT AND INTERPRETATION Progress Report
Roland P. Manriquez, George Merkel, and Daniel J. Spohn Oct. 1979 39 p
(DNA Proj. R99-QAXE808S)
(AD-A080804; HDL-PR-79-5) Avail: NTIS HC A03/MF A01 CSCL 20/14

In a series of experiments, it has been determined that a simple parallel plate transmission line would behave in a predictable manner when subjected to the 13-MeV-thick target bremsstrahlung produced by the AURORA flash X-ray machine. During the experiment, the following parameters were measured: current into the transmission line, current through the matched termination of the transmission line, the electric field at the bottom plate along the center of the transmission line, and a component of the magnetic field at the center of the transmission line. The experimental results were interpreted with a simple lumped parameter model of the transmission line. GRA

N80-23535# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE ZOG APPROACH TO MAN-MACHINE COMMUNICATION Interim Report
G. Robertson, D. McCracken, and A. Newell Oct. 1979 55 p refs
(Contracts N00014-76-C-0874; F33615-78-C-1551)
(AD-A081088; CMU-CS-79-148) Avail: NTIS HC A04/MF A01 CSCL 05/8

ZOG is a rapid response, large network, menu selection system used for man-machine communication. The philosophy behind this style of communication was first developed by the PROMIS (Problem Oriented Medical Information System) Laboratory of the University of Vermont. ZOG has been used in a number of task domains to help explore the limits and potential benefits of the communication philosophy. This paper discusses the basic ideas in ZOG, describes the architecture of a system implemented to carry out that exploration, and discusses our initial experience. GRA

N80-23536# Edgerton, Germeshausen and Grier, Inc., Albuquerque, N. Mex.
E-3A EMP EVALUATION PROGRAM Final Report, Nov. 1977 - Feb. 1979
J. R. Anderson Kirtland AFB, N. Mex. AFWL Oct. 1980 104 p
(Contract F29601-78-C-0013; AF Proj. 3763)
(AD-A081725; AD-E200458; EG/AG-1394; AFWL-TR-79-115)
Avail: NTIS HC A06/MF A01 CSCL 20/14

This document is the final report of the E-3A EMP Evaluation

Test Program conducted for the AFWL at Kirtland Air Force Base. The report is divided into four sections: Test Planning, Test Procedures, Data Management and Test Activities. The Test Planning section emphasizes the importance of pretest activities, demonstrates what can happen if critical items (such as connectors) are not identified early, and makes recommendations for future tests. The Test Procedures section gives a step-by-step detailed explanation for performing an EMP test on a large test object. A great number of the problems the test crew encountered on this program are pointed out and solutions are recommended. A brief discussion on power-on testing and breakout box qualification tests are included at the end of the section. The most detailed section in the report is section 4, Data Management. Virtually every function of Data Management is covered in this section; examples of typical response data, 284 calibration data, Daset log sheets and Adset log sheets are given and explained. The final section, Test Activities, explains to the reader the mechanics of performing a test at the HPD facility. GRA

N80-23537# Atlantic Research Corp., Alexandria, Va.
COMMUNICATIONS-ELECTRONIC INTRASYSTEM ELECTROMAGNETIC INTERFERENCE MEASUREMENT TECHNIQUE AND INSTRUMENTATION Quarterly Report, 21 Sep. - 21 Dec. 1979
Lester E. Polisky, Thomas E. Baldwin, Jr., and John Savage Fort Monmouth, N.J. Army Commun. Res. and Develop. Command Feb. 1980 75 p
(Contract DAAK80-79-C-0786; DA Proj. 1L1-62701-AH-92) (AD-A081830; CORADCOM-79-0786-2; QR-2) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report presents the results obtained during the second quarter of the communications-electronics intrasystem electromagnetic interference measurement techniques and instrumentation project. The period covered was 21 Sep. 1979 to 21 Dec 1979. The major efforts in the second quarter consisted of completing the IEMCAP feasibility study and developing a broadband measurement system for conducting EMC measurements. GRA

N80-23538# Naval Postgraduate School, Monterey, Calif.
CHANNELS THAT COOPERATIVELY SERVICE A DATA STREAM AND VOICE MESSAGES, 1
D. P. Gaver and P. J. Lehoczky (Carnegie-Mellon Univ.) Nov. 1979 46 p refs 2 Vol.
(Contract N00014-80-WR-00067; Grant NSF ENG-79-05526; R0000110)
(AD-A081616; NPS55-79-027-1) Avail: NTIS HC A03/MF A01 CSCL 17/2

A system of channels cooperatively services both voice and data messages arriving at one node of a communications network. This paper is devoted to the analysis of a particular channel-sharing strategy, in which voice traffic always occupies its channels when available, but data service is allowed to occur on empty voice channels. Voice traffic is taken to be of high priority; voice arrivals that find all voice channels busy are treated as losses. Note that voice traffic will be relatively infrequent as compared to data, and will also exhibit relatively long holding (service) times. Data traffic is taken to be heavy, and exhibits very short holding times (per word unit); compared to voice, data appears to arrive nearly continuously; when all data (and empty voice) channels are filled, queueing occurs. GRA

N80-23539# Varian Associates, Palo Alto, Calif. Solid State Lab.
A 3-5 HETEROSTRUCTURE AVALANCHE PHOTODIODE MODULES FOR FIBER OPTIC COMMUNICATION LINKS IN THE 1.0 TO 1.3 MICROMETER SPECTRAL RANGE Interim Report, Feb. - Jul. 1979
R. Yeats Sep. 1979 29 p refs Prepared for Army Communication Research and Development Command, Fort Monmouth, N.J.
(Contract DAAB07-78-C-2402)
(AD-A081185; IR-3) Avail: NTIS HC A03/MF A01 CSCL 09/5

The increased leakage current in InGaAsP APDs near breakdown is found to be a rather uniform bulk property, not associated with conventional microplasmas, dislocations, or surface effects. Surface effects were eliminated by the fabrication of guard ring APDs, but the increased leakage current persisted. Surface effects were further ruled out by a statistical study of a large sample of APDs, which showed conclusively that the APD leakage current is proportional to diode area, not perimeter. Attempts to overcome the leakage current problem are still being made. GRA

N80-23540# Naval Postgraduate School, Monterey, Calif.
CHANNELS THAT COOPERATIVELY SERVICE A DATA STREAM AND VOICE MESSAGES. PART 2: DIFFUSION APPROXIMATIONS
J. P. Lehoczky (Carnegie Mellon Univ.) and D. P. Gaver Nov. 1979 46 p refs
(Contract N00014-80-WR-0054; Grant NSF ENG-79-05526) (AD-A081617; NPS55-79-028) Avail: NTIS HC A03/MF A01 CSCL 17/2

A system of channels mutually accommodate both data and voice messages, voice having preemptive priority but being a loss system, and data being allowed to queue. Approximations to the data queue properties are derived. GRA

N80-23541# Naval Research Lab., Washington, D. C. Microwave Technology Branch.
MEASURED PERFORMANCE CHARACTERISTICS OF REFLECTIVE BUTLER MATRICES Final Report
B. Sheleg and H. E. Heddings 9 Jan. 1980 32 p refs
(RR0210346)
(AD-A081002; AD-E000362; NRL-8361) Avail: NTIS HC A03/MF A01 CSCL 09/5

A reflective Butler matrix is described which has the full electrical performance of a conventional Butler matrix while requiring only 1/2 the usual size and number of circuit components and ports. Reflective networks having eight and 16 ports were built, tested, and evaluated at 1060 MHz. Details of the circuit design and fabrication are included. The measured performance characteristics of the reflective Butler matrix are shown to compare well with those of conventional Butler matrix. GRA

N80-23542# Varian Associates, Palo Alto, Calif. Solid State Lab.
THE 3-V HETEROSTRUCTURE AVALANCHE PHOTODIODE MODULES FOR FIBER OPTIC COMMUNICATION LINKS IN THE 1.0 TO 1.3 MICROMETER SPECTRAL RANGE Interim Technical Report, Aug. 1978 - Feb. 1979
R. Yeats and S. H. Chiao Apr. 1979 51 p refs
(Contract DAAB07-78-C-2402)
(AD-A081747; ITR-2) Avail: NTIS HC A04/MF A01 CSCL 17/2

InGaAsP APDs have been fabricated with uniform high-speed gains up to 42 and quantum efficiencies up to 70% at 1.28 micrometers. At high gains increased leakage current leads to excessive shot noise and gain saturation. Noise measurements indicate that the increased leakage current arises from a uniformly multiplied but increasing value of the primary (i.e., premultiplication) leakage current. To try to reduce this leakage current, various procedures for fabricating guard ring APDs have been studied. Preliminary guard ring structures have demonstrated guard ring isolation by exhibiting avalanche gain in the central region only. However, these initial guard ring APDs need further development before a meaningful comparison can be made to APDs without guard rings. GRA

N80-23543# Defence Research Establishment, Ottawa. (Ontario). Energy Conversion Div.
TEST AND EVALUATION OF MK 37 TORPEDO BATTERIES
G. J. Donaldson and William D. Barnes Dec. 1979 27 p refs
(AD-A081642; DREO-TN-79-34) Avail: NTIS HC A03/MF A01 CSCL 10/3

The exercise and warshot batteries for the MK 37 torpedo were tested against the electrical specifications of the manufacturer. Both battery types fail to meet the minimum power requirements during the three second, high rate (130A) portion of the discharge test. The warshot batteries performed as specified for the main part of the discharge test. Due to the limited number of test batteries examined it was not possible to estimate the cycle life expectancy for the rechargeable exercise battery. Electrolyte levels within some cells of the exercise battery were found to decrease over a time interval of several months. Additional

electrolyte should be provided as a routine servicing procedure. Some indication of imminent cell failure is provided by the open circuit voltage after at least a one day stand. It is indicated that low open circuit voltage may be taken as sufficient reason for the replacement of the 4 cell monoblock in the exercise battery. R.C.T.

N80-23544# Regis Coll., Weston, Mass.
DEVELOPMENT AND EVALUATION OF ADAPTIVE TECHNIQUES FOR REDUCING IONOSPHERIC-INDUCED RADAR TRACKING ERRORS IN REAL TIME Final Report, 1 Oct. 1978 - 30 Sep. 1979
D. E. Donatelli-DuLong 30 Sep. 1979 52 p refs
(Contract F19628-76-C-0255; AF Proj. 4643)
(AD-A081460; AFGL-TR-79-0256) Avail: NTIS HC A04/MF A01 CSCL 17/9

Adaptive procedures, using real time measurements of ionospheric parameters to reduce r.m.s. errors in predictions, are analyzed, addressing both additive and multiplicative processes as contributors to ionospheric variability. A particular procedure is tested using total electron content data from four stations at solar maximum and three stations at solar minimum. Its impact on radar, navigation and communication systems is evaluated, considering diurnal, seasonal and solar cycle effects. A space-time correlation cell is defined and cell limits established on the basis of temporal and spatial growth rate of r.m.s. residual error. Results indicate that an adapted prediction can significantly improve system performance, particularly in daytime at solar maximum when ionospheric refraction effects are most severe. GRA

N80-23545# Technology Service Corp., Silver Spring, Md.
A REVIEW OF REPRESENTATION FUNCTIONS FOR PROBABILITY OF DETECTION
Wayne Rivers, J. N. Bucknam, E. N. Khoury, and R. E. Blase 11 Jan. 1980 120 p refs
(Contracts N60921-79-C-A306; N00024-78-C-7065)
(AD-A081734; TSC-W25-160) Avail: NTIS HC A06/MF A01 CSCL 17/9

Simple representation functions tht interrelate the primary signal detection variables for the receiver structure of Marcum and Swerling are reviewed in regard to acuracy, complexity and inversion. Functions reviewed include those of Brooks, Neuvy, and Khoury-Bucknam. The first two of these are simple algorithms for computing minimum ratio of signal energy to noise power density as functions of number of samples integrated, the target distribution case, and required probabilities of detection and false alarm. The Khoury-Bucknam functions are analytic and invertable, and they relate probability of detection and signal-to-noise ratio using parameters chosen uniquely for each case, number of samples, and probability of false alarm. The procedures and software that support determination of the coefficients of the Khoury-Bucknam functior are documented. GRA

N80-23546# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
LASER COMMUNICATION CLIMATOLOGY STUDY Interim Report
May 1979 23 p refs
(Contract N00014-78-C-0539)
(AD-A081656) Avail: NTIS HC A02/MF A01 CSCL 17/2

This report summarizes the progress made during the first half of the climatology study contract period. It presents preliminary results which are useful in estimating the availability of space-to-Earth optical communication systems. GRA

N80-23547# Atmospheric Sciences Office, White Sands Missile Range, N. Mex.
ATMOSPHERIC EFFECTS ON MILLIMETER RADIO WAVES
H. K. Kobayashi Jan. 1980 56 p refs
(DA Proj. 1L1-62111-AH-71)
(AD-A081414; ERADCOM/ASL-TR-0049) Avail: NTIS HC A04/MF A01 CSCL 20/12

This report is a short survey intended to present the atmosphere's effect on millimeter waves. The emphasis is on rain and raindrop-size distributions. This emphasis is appropriate because rain (the most common nongaseous constituent of the lower atmosphere) also has the greatest effect on millimeter waves, and raindrop-size distribution is needed to compute the theoretical and measured extinction of radio waves. The pressing need to acquire short-time data on raindrop-size distribution, particularly in the smallest size classes, is emphasized. Likewise, the acquisition of data on atmospheric fluctuations will determine how well millimeter-wave propagation through turbulence will be understood. GRA

N80-23548# Communications Research Centre, Ottawa (Ontario). Dept. of Communications.
MAXIMUM ENTROPY SPECTRAL ANALYSIS AND RADAR SIGNAL PROCESSING
R. W. Herring Jan. 1980 49 p refs Sponsored by Dept. of National Defence, Ottawa
(AD-A081343; CRC-1330) Avail: NTIS HC A03/MF A01 CSCL 17/9

The theory and derivation of the maximum-entropy method of spectral analysis and the Burg algorithm, and the potential applicability of these techniques to radar signal processing, are reviewed. This material is presented in a readily comprehensible form for assessment by the practicing radar engineer. Topics such as computational complexity, statistical properties, adaptive clutter suppression and angular spectrum estimation are discussed. It is concluded that, at least at present, maximum-entropy spectral analysis is not a panacea for radar signal processing, due to its substantial computational requirements, and the relatively unknown and potentially unfavorable statistical properties of data analyzed using the Burg algorithm. A promising area of applicability appears to be that of adaptive Doppler filtering. GRA

N80-23549# Brookhaven National Lab., Upton, N. Y.
ELECTROMAGNETIC INTERACTION OF COLLIDING BEAMS ON STORAGE RINGS
J. C. Herrera 1979 13 p ref Presented at Symp. on Nonlinear Dyn. and the Beam-Beam Interaction, Upton, N.Y., 19-21 Mar. 1979
(Contract EY-76-C-02-0016)
(BNL-27035; CONF-790318-8) Avail: NTIS HC A02/MF A01

When the beams cross each other in the intersection region of a storage ring, two distinct effects occur. A particle of one beam may undergo a fundamental interaction with a particle of the other beam. The average number of such events is equal to the product of the machine luminosity and the particle-particle total cross section. In contrast to what happens for these fundamental interactions, a particle of one beam passing through the interaction region will always be influenced by the electric and magnetic fields produced by the entire other beam. Clearly, this classical electromagnetic interaction between the two beams will perturb the motion of the particles circulating in the machine. The basic aspects of this beam-particle force are presented. The effect of this electrical force is quite different in the case of continuous (unbunched) proton beams which cross each other at the angle (as in the ISR at CERN and in ISABELLE at Brookhaven), as compared to the case of electron-positron bunches which collide head on (as in the SPEAR 2 ring and in PETRA and PEP). DOE

N80-23550# AEG-Telefunken, Ulm (West Germany). Research Inst.
VIDEO TELEPHONE SYSTEM WITH DATA COMPRESSION FOR INCREASED COMMERCIAL REQUIREMENTS Final Report
Georg Kummerfeldt and Franz May Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1979 196 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-01) Avail: NTIS HC A09/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 40,75

The design of an improved version of a video telephone system for commercial applications was investigated. Problems that were studied in detail include picture quality, channel coding, data compression techniques for continuous gray scale and facsimile signals, and compatibility with already existing systems. Author (ESA)

N80-23551# AEG-Telefunken, Ulm (West Germany). Research Inst.

BASIC STUDIES FOR A NEW COMMUNICATION NETWORK. PART A: AN INTEGRATED COMMUNICATION SYSTEM WITH DECENTRALIZED SWITCHING Final Report

Wolfgang Herzig, Rupert Hildenbrand, and Max Proegler Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1979 179 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. 2 Vol.

(BMFT-FB-T-79-07-Pt-A) Avail: NTIS HC A09/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 37,20

A digital communication system with decentralized switching and integration of broadcasting services and dialed connections at different bandwidths is described. The subscribers are connected to wideband twin lines in a branched, multiple access network. The network is synchronized both with respect to the bit rate and the frame phase. A hardware model is also presented.

Author (ESA)

N80-23552# AEG-Telefunken, Ulm (West Germany). Research Inst.

BASIC STUDIES FOR A NEW COMMUNICATION NETWORK. PART B: MOBILE RADIO TELEPHONE Final Report

Michael Aldinger, Horst Maly, and Karl Neumann Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 207 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-08) Avail: NTIS HC A10/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 43,05

A mobile radio telephone system with digitally encoded access and transmission was developed and tested. The system consists of a fixed relay station and a maximum of five mobile stations. It has a range of about 1 km radius and operates at data rates of 19,200 bits/sec.

Author (ESA)

N80-23553# AEG-Telefunken, Heilbronn (West Germany). Serienprodukte Aktienges.

TECHNOLOGY FOR THE MONOLITHIC INTEGRATION OF UHF DEVICES Final Report

Klaus Woerner Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 85 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-13) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 17,45

The development of a technology for monolithic integration of ultrahigh frequency devices is described. Transistors with cut-off frequencies of up to 6 GHz were produced using ion implantation for the base and arsenic diffusion for the emitter. Methods for the simulating and optimizing of UHF devices were developed. A monolithic integrated wideband amplifier with 1 GHz bandwidth was produced.

Author (ESA)

N80-23554# Fraunhofer Institut, Freiburg (West Germany). Angewandte Festkoerperphysik.

TECHNOLOGIES OF IMAGING FOR COMMUNICATION TERMINALS Final Report

Guenter Baur, Manfred Schiekel, and Karl Walter Bonn Aug. 1979 220 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-38) Avail: NTIS HC A10/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 45,80

A review of technologies for imaging and a discussion of their possible spinoff on prospective terminal equipment in telecommunication system is presented, including a survey of human factors and their influence on display systems. The present state and future trends in the development of components and subsystems for imaging are also analyzed. The consequences for the development of improved and novel equipment are discussed, especially in the field of television and telephone.

Author (ESA)

N80-23555# TICRA ApS, Copenhagen (Denmark).

STUDY AND DEVELOPMENT OF A COMPUTER PROGRAM FOR ANALYSIS OF SAR PLANAR ARRAY ANTENNAS Final Report

N. C. Albertsen and P. Balling May 1979 100 p refs

(Contract ESA-3693/78-NL-AK(SC))

(S-110-02; ESA-CR(P)-1297) Avail: NTIS HC A05/MF A01

The development of a computer program TOPAS for analysis of planar array antennas, in particular synthetic aperture radar (SAR) antennas, is described. The program is divided into a number of modules, each of which can be used to analyze the antenna at a certain level. It was developed on a PRIME 300 minicomputer. The first calculates the realized element excitations; taking into account mutual coupling; the second module calculates the radiation pattern, taking into account possible degradations of the array. The third module presents the data in user oriented formats such as: theta-phi plots, u-v plots, isogain curves on the ground, along track and across track curves, and integrated side-lobe level.

Author (ESA)

N80-23556# GEC-Marconi Electronics Ltd., Chelmsford (England).

A STUDY OF SPECTRUM EFFICIENT MODULATION TECHNIQUES FOR DIGITAL SATELLITE COMMUNICATIONS Final Report

P. N. Sargeaunt, ed., M. J. D. Staniforth, B. G. West, G. G. Windus, J. K. Potts, R. J. Millard, and G. R. Brooks Jun. 1979 515 p refs

(Contract ESTEC-3397/77-NL-AK(SC))

(Y/212/5086; ESA-CR(P)-1298) Copyright. Avail: NTIS HC A22/MF A01

The feasibility of achieving an information rate to an occupied bandwidth ratio of 3 bits per Hz in digital satellite systems was studied as a solution to the problem of saturation of the frequency band allocated to satellite communications. Taking the 4 level PSK method as reference, multilevel phase shift keying, hybrid amplitude/phase shift keying, and partial response signaling techniques are discussed. Principles, implementation, the effect of circuit and system imperfections, are discussed, as well as compatibility with typical satellite communication applications. Satellite utilization with 16 PSK, 16 QASK, and 8 DPSK is studied, and consideration is given to the possible use of error correcting codes in signal-to-noise ratio limited situations.

Author (ESA)

N80-23557# Institute for Telecommunication Sciences, Boulder, Colo.

SIGNAL LEVEL DISTRIBUTIONS AND FADE EVENT ANALYSES FOR A 5 GHz MICROWAVE LINK ACROSS THE ENGLISH CHANNEL

D. R. Wortendyke, A. P. Barsis, and R. R. Larsen (Electronics Engineering Group (1842nd), Scott AFB, Ill.) Oct. 1979 29 p refs

(PB80-129398; NTIA/REPT-79/30) Avail: NTIS HC A03/MF A01 CSCL 17B

This report describes instrumentation for fading studies and measurement results over an 88 km multiple-diversity line-of-sight microwave link across the English Channel operating in the 4 to 5 GHz frequency range. Signal level and fade duration statistics derived from the measurments are compared with CCIR models. It is found that median fade duration tends to be less than estimates from the CCIR models.

GRA

N80-23558# Institute for Telecommunication Sciences, Boulder, Colo.

PERFORMANCE OF A VERY LONG 8 GHz MICROWAVE LINK

Nov. 1979 106 p refs Sponsored in part by Electronic Systems Div., Hanscom AFB, Mass.

(PB80-129380; NTIA/REP-79/31) Avail: NTIS HC A06/MF A01 CSCL 17B

Measurement of signals received over a 160 km (100 mile) line-of-sight microwave radio link operating at 8.4 GHz is discussed. The effects of macro-scale meteorological conditions are discussed particularly those which are peculiar to the central European location of the path. The data obtained from this measurement effort are presented both in terms of radio link availability and in terms of long-term propagation performance.

The data were also analyzed to obtain distributions of fade duration for single receivers and for both receivers in a diversity configuration. It is shown that it is possible to achieve reliable propagation at 8 GHz on a link as long as 160 km and with less than normal diversity spacing. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N80-23559* National Aeronautics and Space Administration. Pasadena Office, Calif.
PASSIVE INTRUSION DETECTION SYSTEM Patent
Eric G. Laue, inventor (to NASA) (JPL) Issued 8 Apr. 1980 5 p Filed 9 Feb. 1977 Supersedes N77-19390 (15 - 10, p 1311) Sponsored by NASA
(NASA-Case-NPO-13804-1; US-Patent-4,197,530; US-Patent-Appl-SN-766999; US-Patent-Class-340-602; US-Patent-Class-310-319; US-Patent-Class-331-65; US-Patent-Class-340-604) Avail: US Patent and Trademark Office CSCL 09C

An intrusion detection system is described in which crystal oscillators are used to provide a frequency which varies as a function of fluctuations of a particular environmental property of the atmosphere, e.g., humidity, in the protected volume. The system is based on the discovery that the frequency of an oscillator whose crystal is humidity sensitive, varies at a frequency or rate which is within a known frequency band, due to the entry of an intruder into the protected volume. The variable frequency is converted into a voltage which is then filtered by a filtering arrangement which permits only voltage variations at frequencies within the known frequency band to activate an alarm, while inhibiting the alarm activation when the voltage frequency is below or above the known frequency band.
Official Gazette of the U.S. Patent and Trademark Office

N80-23560 Stanford Univ., Calif.
AN INSULATED-GATE THYRISTOR STRUCTURE: PRINCIPLES OF OPERATION AND DESIGN Ph.D. Thesis
Brad Whitney Scarf 1980 258 p
Avail: Univ. Microfilms Order No. 8011706

A thyristor configuration, developed for high power semiconductor switching functions, with a metal-oxide-semiconductor (MOS) gate that greatly reduces control-circuit power consumption, improves isolation and simplifies the interfacing of low- and high-power segments is discussed. This is not achieved by circuit techniques but by a single merged device that incorporates mechanisms found in both MCS and bipolar transistors. Although the insulated configuration is suitable for many types of thyristors and voltage and current levels, it has been repeatedly fabricated and extensively analyzed in the form of a planar 150 V bilateral switch called TRIMOS which is fully integrable and is based on a double-diffused MOS (DMOS) fabrication process. The overall current-voltage characteristics are described in terms of a simple equivalent circuit of MOS and bipolar transistors that are directly related to the physical structure. Computer analysis of the circuit leads to accurate simulation of TRIMOS characteristics in the nonregenerative region. Finally, a description of TRIMOS fabrication and design relates performance limitations to the present structure and to fundamental material properties.
Dissert. Abstr.

N80-23561 Minnesota Univ., Minneapolis.
TWO-DIMENSIONAL KALMAN FILTERING AND ITS APPLICATION TO IMAGE RESTORATION Ph.D. Thesis
Bindinganavle Raghavan Suresh 1979 162 p
Avail: Univ. Microfilms Order No. 8011892

The problem of image restoration was investigated. Image restoration techniques were defined in terms of their capability to mathematically model degrading phenomena and attempt to reverse the corrupting influences. An estimate of the original image was obtained through the use of a two dimensional Kalman filter. The filter was implemented by using the strip filtering technique. Strip filtering provided excellent results. Results indicate that the technique is also capable of handling nonstationary images. Dissert. Abstr.

N80-23562 Georgia Inst. of Tech., Atlanta.
DESIGN, STABILITY AND PERFORMANCE OF TWO-DIMENSIONAL RECURSIVE DIGITAL FILTERS Ph.D. Thesis
Gary Alan Shaw 1979 293 p
Avail: Univ. Microfilms Order No. 8010008

Solution methods and algorithms for problems associated with two dimensional recursive digital filter design are developed. Stability testing, stabilization, and space domain design are specifically addressed. Two aspects of recursive filter performance, their efficiency and susceptibility to instability are also investigated by means of a computer study. The major contribution in the area of stability is an efficient algorithm for testing stability of any recursive filter by phase unwrapping. The algorithm is shown to be reliable and computationally efficient. In the area of stabilization, an algorithm is proposed for stabilizing recursive filters with any type of support while approximately preserving the magnitude response. Two algorithms for space domain approximation of a desired response by a recursive filter are proposed and applied to design numerous filters. The algorithms minimize the sum-of-square error between the desired unit-pulse response and the unit-pulse response of the recursive filter over a finite area of the response plane. Performance of the two algorithms is compared. Dissert. Abstr.

N80-23563*# Old Dominion Univ. Research Foundation, Norfolk, Va.
DIGITAL SIMULATION OF DYNAMIC PROCESSES IN RADIOMETER SYSTEMS Contractor Report, 1 Jan. - 31 Dec. 1978
William D. Stanley May 1980 48 p refs
(Contract NAS1-14193)
(NASA-CR-159266) Avail: NTIS HC A03/MF A01 CSCL 09C

The development and application of several computer programs for simulating different classes of microwave radiometers are described. The programs are dynamic in nature, and they may be used to determine the instantaneous behavior of system variables as a function of time. Some of the programs employ random variable models in the simulations so that the statistical nature of the results may be investigated. The programs have been developed to utilize either the Continuous System Modeling Program or the Advanced Continuous System Language. The validity of most of the programs was investigated using statistical tests, and the results show excellent correlation with theoretical predictions. The programs are currently being used in the investigation of new design techniques for microwave radiometers. A.R.H.

N80-23564# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A DYNAMIC PROGRAMMING ALGORITHM FOR PHASE ESTIMATION AND DATA DECODING ON RANDOM PHASE CHANNELS
Odile Macchi and Louis L. Sharf Dec. 1979 62 p refs
(Contract N00014-75-C-0518)
(AD-A081314; CSU-TR-DEC79-3) Avail: NTIS HC A04/MF A01 CSCL 09/4

The problem of simultaneously estimating phase and decoding data symbols from baseband data is posed. The phase sequence is assumed to be a random sequence on the circle and the symbols are assumed to be equally-likely symbols transmitted over a perfectly equalized channel. A dynamic programming algorithm (Viterbi algorithm) is derived for decoding a maximum a posteriori (MAP) phase-symbol sequence on a finite dimensional phase-symbol trellis. A new and interesting principle of optimality for simultaneously estimating phase and decoding phase-amplitude coded symbols leads to an efficient two step decoding procedure for decoding phase-symbol sequences. Simulation results for binary, 8-ARY PM, and 16-QASK symbol sets transmitted over random walk and sinusoidal jitter channels are presented, and

compared with results one may obtain with a decision-directed algorithm, or with the binary Viterbi algorithm introduced by Ungerboeck. When phase fluctuations are severe, and the symbol set is rich (as in 16-QASK), MAP phase-symbol sequence decoding on circles is superior to Ungerboeck's technique, which in turn is superior to decision-directed techniques. GRA

N80-23565# Hughes Aircraft Co., Torrance, Calif. Electron Dynamics Div.
AN/TPQ-37 TRANSMITTER TUBE IMPROVEMENTS Interim Report, 28 Sep. 1978 - 28 Mar. 1979
S. L. Bosma 27 Apr. 1979 28 p
(Contract DAAB07-78-C-3008)
(AD-A081393; EDD-W-081401; ERADCOM-78-C-3008-1; IR-1) Avail: NTIS HC A03/MF A01 CSCL 17/9

The purpose of this program is to improve the performance and reliability of the AN/TPQ-37 transmitter tube. The task is to build and test two high power, PPM focused, grid pulsed Traveling Wave Tubes TWT that meet the requirements of Technical Guidelines MW-119 B. The TWT will employ a M-type cathode for reduced temperature operation and extended life. Gain variations will be minimized by use of in-band loss techniques and weight will be reduced by using samarium cobalt magnets. Author (GRA)

N80-23566# Massachusetts Inst. of Tech., Cambridge. Lab for Information and Decision Systems.
NEW RESULTS ON THE INNOVATIONS PROBLEM FOR NON-LINEAR FILTERING Interim Report
Deborah F. Allinger and Sanjoy K. Mitter Jan. 1980 16 p refs
(Grant AF-AFOSR-3281-77; AF Proj. 2304)
(AD-A081574; LIDS-R-964; AFOSR-80-0131TR) Avail: NTIS HC A02/MF A01 CSCL 09/3

This report considers an observed stochastic process consisting of a signal with additive noise. It assumes that the signal has finite energy and that the signal and noise are independent. In this paper it is also shown, that under the above assumptions the innovations and observations algebra are equal, and thereby it provides a long-standing conjecture of Kailath. GRA

N80-23567# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
DESIGN OF SPECIAL-PURPOSE VLSI CHIPS: EXAMPLE AND OPINIONS Interim Report
M. J. Foster and H. T. Kung Sep. 1979 35 p refs
(Contracts N00014-76-C-0370; F33615-78-C-1551; Grant NSF MSC-78-23676)
(AD-A081451; CMU-CS-79-147) Avail: NTIS HC A03/MF A01 CSCL 09/3

This paper identifies important steps in the design of a special purpose VLSI chip, and argues that the most crucial step is the design of the underlying algorithm. Because the algorithm determines the degree of parallelism and pipelining that is possible, it largely determines the performance of the chip. Furthermore, if the underlying algorithm has the right properties such as modularity and regularity, then the rest of the design should be routine and thus takes little effort. These claims are supported by a concrete example--the design of an efficient pattern matching chip, which has been fabricated for testing. GRA

N80-23568# Martin Marietta Labs., Baltimore, Md.
INTERFACE PROPERTIES AND SURFACE LEAKAGE OF HgCdTe PHOTODIODES Interim Report, 30 Aug. 1979 - 9 Jan. 1980
T. S. Sun, S. P. Buchner, and N. E. Byer Jan. 1980 39 p refs
(Contract DAAK70-79-C-0134)
(AD-A081530; MML-TR-80-3C) Avail: NTIS HC A03/MF A01 CSCL 09/1

A program was undertaken to determine the origin of surface leakage associated with Hg sub 1-x Cd sub x TE photodiodes and to seek improved surface passivation techniques. To attain this goal, emphasis was placed on surface spectroscopic analyses and metal-insulator-semiconductor (MIS) characteristics of candidate passivants. During the initial four months of the program, the insulating and interfacial properties of anodic oxides and ZnS on $Hg_{0.8}Cd_{0.2}Te$ were investigated. X-ray photoelectron spectroscopy (XPS) techniques were developed for determining depth profiles of compositional variations in the semiconductor with a minimum materials damage. Using these techniques, we found that (a) the composition of a 1200 angstrom anodic film is 68% TeO_2, 27% CdO, and 8% HgO, and (b) the cations, especially the Hg ions in the semiconductor, are significantly depleted near the interface. The capacitance-voltage curves from MIS measurements of the same specimen exhibited a large hysteresis and a characteristic indicative of a high density of surface states. The consequence of these chemical and electrical properties to diode passivation is discussed. GRA

N80-23569# Ohio State Univ., Columbus. ElectroScience Lab.
THE PERFORMANCE OF A SAMPLED DATA DELAY LOCK LOOP IMPLEMENTED WITH A KALMAN LOOP FILTER M.S. Thesis. Interim Report, Dec. 1978 - Mar. 1979
H. S. Eilts Griffiss AFB, N.Y. RADC Jan. 1980 99 p refs
(Contract F30602-79-C-0068; AF Proj. 4519)
(AD-A081822; ESL-711679-1; RADC-TR-79-333) Avail: NTIS HC A05/MF A01 CSCL 09/5

The purpose of this study is to evaluate the steady-state and transient (lock-up) performance of a tracking loop implemented with a Kalman filter. Steady-state performance criteria are errors due to measurement noise (jitter) and Doppler errors due to motion of the tracking loop. Trade-offs exist between the two criteria such that increasing performance with respect to either one will cause performance decrease with respect to the other. It is shown that by carefully selecting filter parameters reasonable performance can be obtained for both criteria simultaneously. It is also shown that lock-up performance for the loop is acceptable when these parameters are used. GRA

N80-23570# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
AUTOCLAVE TESTING OF PLASTIC ENCAPSULATED 4001 CMOS INTEGRATED CIRCUITS
Richard Holecinski Jan. 1980 30 p refs
(DA Proj. 1L1-62705-AH-94)
(AD-A081555; DELET-TR-80-2) Avail: NTIS HC A03/MF A01 CSCL 09/5

Samples from 10 vendors of CMOS 4001 plastic encapsulated integrated circuits were tested in an autoclave at 121 C, 100% RH and 15 psig with and without electrical bias. Twenty-nine test groups of 16 circuits each accumulated over 200,000 device hours. Failure analyses were performed to verify moisture related electrochemical aluminum metal corrosion on the die. Weibull failure distributions showed large differences in moisture resistance reliability among the various vendor products. Test devices with newer data coded packages had longer median life times. There was no correlation of median life time between groups with and without electrical bias. GRA

N80-23571# Hughes Aircraft Co., Fullerton, Calif.
PHOTOLITHOGRAPHIC TECHNIQUES FOR SURFACE ACOUSTIC WAVE SAW DEVICES. VOLUME 4: TECHNICAL AND OPERATIONAL PARTS 4 AND 5 Final Report, 1 Jul. 1975 - 31 Dec. 1978
A. W. Dozier Fort Monmouth, N.J. Army Electronics Research and Development Command Dec. 1978 232 p
(Contract DAAB07-75-C-0044)
(AD-A081126; HAC-FR-79-12-40-Vol-4; DELET-TR-75-0044-F-Vol-9) Avail: NTIS HC A10/MF A01 CSCL 09/5

The object of the program was the establishment of a production capability for surface acoustic wave devices of varied design and material for the purpose of meeting estimated military needs and to establish a base and plans which may be used to meet expanded requirements. The primary requirement was the pilot line production of devices that are reliable, reproducible, and low cost. Phase 3 involved fabrication of a large quantity of confirmatory devices which were sampled at a high rate and subjected to rigorous life and environmental testing. Phase 3 was successfully completed with delivery and acceptance of the confirmatory samples. The device configuration is detailed as it existed for Phase 3 along with assembly details, results and conclusions from the Confirmatory Sample production run. The

Fourth Engineering Phase (Phase 4) of the program was pilot line production effort of 150 each of the devices scheduled to be delivered. Solder sealing was identified as a problem area during Phase 4 for SAW devices in semiconductor pin packages. New solder seal screening and processing procedures were investigated. In addition, alternative sealing approaches were evaluated. These procedures, Tungsten Inert Gas (TIG) and projection and seam welding were demonstrated to be more compatible with SAW processing. They are especially suitable for high volume production. GRA

N80-23572# Bendix Corp., Baltimore, Md. Communications Div.

TACTICAL MINIATURE CRYSTAL OSILLATOR Semiannual Report, 1 Oct. 1978 - ? Apr. 1979

D. L. Hanton and D. Brown Dec. 1979 95 p refs

(Contract DAAB07-78-C-2990; DA Proj. 1L1-62705-AH-94)

(AD-A080769; DELET-TR-78-2990-1) Avail: NTIS HC A05/MF A01 CSCL 09/5

This report describes the advanced development of a fast warmup Tactical Miniature Crystal Oscillator (TMXO). The intended use of this TMXO is as a precision frequency/time reference in advanced communications, navigation and position location systems. The present effort is a continuation of work based on the demonstrated feasibility on previous contracts. The TMXO is an evacuated enclosure containing an evacuated inner electronics container. The electronics assembly consisting of two hybrid substances and the crystal resonator is suspended by its lead from the header of the evacuated inner container. The inner container is in turn supported by a system of Kovar wires (which also provide electrical connections) that feed through the header of the outer container. Both the inner and outer containers are hermetically sealed and the space between the containers is evacuated. Removal of the gas between the two containers eliminates heat transfer due to gas conduction and convection. This leaves only conduction through the Kovar wires and radiation as thermal coupling mechanisms between the inner container and the outer environment. GRA

N80-23573# Naval Ship Research and Development Center, Annapolis, Md. Propulsion and Auxiliary Systems Dept.

THE EFFECT OF A SATURATED SHIELD DESIGN ON THE DESIGN, WEIGHT, AND PERFORMANCE OF SUPERCONDUCTIVE ACYCLIC MACHINERY Interim Report

Geoffrey Green 29 Jun. 1979 36 p

(AD-A080919; DTNSRDC-PAS-79-29) Avail: NTIS HC A03/MF A01 CSCL 09/5

The estimated weight advantage of designing a superconducting homopolar acyclic machine with a saturated magnetic shield is presented, and the possible power or flux loss due to the saturation of the iron is reported. A method of estimating the magnetic field at 15.23 centimeters from the saturated magnetic shield is shown in addition to indicating how the fields at large distances vary for hexapole and quadrupole designs. GRA

N80-23574# Texas Instruments, Inc., Dallas. Central Research Labs.

MONOLITHIC INTEGRATION OF MICROWAVE GaAs POWER FETs Annual Technical Report, 1 Oct. 1978 - 30 Sep. 1978

V. Sokolov and R. E. Williams Nov. 1979 48 p refs Prepared for ONR

(Contract N00014-77-C-0657; NR Proj. 251-026)

(AD-A080793) Avail: NTIS HC A03/MF A01 CSCL 09/1

Efforts during the second year of this contract have included investigations of monolithic integration of GaAs power field effect transistors (FETs) at X-band microwave frequencies and incorporation of on-chip matching using lumped elements and coplanar ground metallization for monolithic FET circuit design. Two monolithic circuits have been investigated - a push-pull two-stage amplifier on a 2.0 x 2.0 mm chip, and a three-transistor paraphase amplifier on a 2.0 x 2.4 mm chip. Results for the two-stage push-pull amplifier include 1.4 W with 12.4 dB gain at 9.0 GHz. To provide the necessary 180 deg. out-of-phase signals for the push-pull devices, 180 deg. hybrid rings fabricated on alumina substrates are used. Fabrication of the paraphase amplifier, which is intended to replace the input 180 deg. hybrid ring, and preliminary evaluation of these chips have also been done. GRA

N80-23575# Varian Associates, Palo Alto, Calif. Microwave Tube Div.

EFFICIENCY IMPROVEMENTS IN COUPLED CAVITY TRAVELING WAVE TUBES Final Report, 10 Mar. 1978 - 10 Jun. 1979

W. R. Ayers and F. Ruth Walker Griffiss AFB, N.Y. RADC, Oct. 1979 253 p refs

(Contract F30602-78-C-0117; AF Proj. 4506)

(AD-A080961; RADC-TR-79-264) Avail: NTIS HC A10/MF A01 CSCL 09/1

This report describes an analytical study of schemes for maximizing the conversion efficiency in high power coupled-cavity traveling-wave tubes. The procedures developed in this study were used to design a 100 KW, S-band coupled-cavity TWT with a predicted 40 percent conversion efficiency. GRA

N80-23576# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.

AN/TPQ-37 TRANSMITTER TEST BED Interim Report, Feb. - Jul. 1979

W. L. McPeak and E. J. Bonem Feb. 1980 22 p

(Contract DAAB07-78-C-3010)

(AD-A081591; HAC-FR-80-14-239; DELET-TR-78-3010-2; IR-2) Avail: NTIS HC A02/MF A01 CSCL 17/9

The AN/TPQ-37 Transmitter Test Bed will provide a vehicle for evaluating techniques for improving the reliability and maintainability of the AN/TPQ-37 Transmitter. Work includes design and fabrication of a major portion of the microprocessor based fault isolation subsystem. Support has been provided to ERADCOM in monitoring procurement of Advanced Design Traveling Wave Tubes. During a later phase of the program these TWTs will be evaluated in the AN/TPQ-37 transmitter. GRA

N80-23577# TRW Defense and Space Systems Group, Redondo Beach, Calif. Power Conversion Electronics Dept.

THE ac-dc POWER PROCESSOR, TYPE 1 Final Report, Mar. 1976 - Mar. 1978

John J. Biess Fort Monmouth, N.J. Army Electron. Technol. and Devices Lab. Nov. 1979 101 p refs

(Contract DAAB07-76-C-1336; DA Proj. 1F2-63702-DG-11)

(AD-A081545; TRW-29518-6001-RU-00; DELET-TR-76-1336-F) Avail: NTIS HC A06/MF A01 CSCL 10/2

The ac-dc power processor type 1 power module furnishes 0-100Adc over an output voltage range of 24 to 32Vdc from a 120/208 30 50/60/400Hz power source. Remote output voltage sensing at the load circuit is provided to eliminate the IR drop of the power distribution cabling between the power module and the load. The power module can also be used for battery charging from 5 to 100A. A thyristor series LC resonant inverter power stage is used to provide the output power control and regulation, input/output ground isolation and protection of the power thyristor. The power supply is constructed in accordance with the shelter-installed, mobile GE equipment for shelter or van use without the use of fans for cooling. The internal electronics are modularized according to circuit function with provisions for easy removal and repair. GRA

N80-23578# Electrochemical Technology Corp., Seattle, Wash.

DETERMINATION OF THE EFFECT OF COMPOSITION, STRUCTURE AND ELECTROCHEMICAL MASS TRANSPORT PROPERTIES ON ADHESION AND CORROSION INHIBITION OF PAINT FILMS Annual Progress Report, Oct. 1978 - Oct. 1979

Theodore R. Beck Dec. 1979 174 p refs

(Contract N00014-79-C-0021)

(AD-A080960; APR-1) Avail: NTIS HC A09/MF A01 CSCL 11/3

Seven different paint systems were formulated to meet military specifications of paints used by the Navy. These included three vinyl resins, two polyurethanes, and two epoxy resin systems. Unpigmented free films of all of these systems were prepared for various physical and chemical measurements. Chemical formulas, molecular weights, and structures of these resins are

known. Three characterization tests were used, infrared and ultraviolet spectroscopy and dynamic mechanical properties measured on a Rheovibron instrument. The loss tangent for all of the systems rapidly increased around or slightly above room temperature. The nonlinear changes in mechanical properties around and above room temperature are indicative of structural changes that would certainly influence mass transport properties of the films. GRA

N80-23578# Stanford Univ., Calif. Edward L. Ginzton Lab.
TRANSDUCER ARRAYS SUITABLE FOR ACOUSTIC IMAGING Ph.D. Thesis
Charles S. DeSilets Jun. 1978 190 p refs
(Contracts N00014-75-C-0632)
(AD-A080970; GL-2833) Avail: NTIS HC A09/MF A01 CSCL 20/1

The design and development of piezoelectric transducer arrays suitable for use in electronically scanned and focused acousitc imaging systems is described. These arrays are designed to operate in the frequency range 2-5 MHz within 45% to 80% fractional bandwidths. Linear arrays of up to 180 elements have been built and used extensively in acoustic imaging systems. Particular attention is placed on achieving high transduction efficiency and angular beam-widths of at least + or - 15 deg. Design techniques based on the tranmission line model of the transducer of Krimholtz, Leedom, and Matthaei are formulated for achieving efficient, broadband operation. These techniques involve the use of quarter-wave matching layers between a high impedance ceramic and a low impedance load. Broadband matching criteria are generated, and a novel technique for selecting the quarter-wave matching layer impedances is described. The theoretical transient response of the transducer is obtained by taking the Fourier transform of the transfer function of the transducer. An experimental transducer built using the formulated design techniques is described and its characteristics compared to theory. Slotted transducer arrays employing tall, narrow elements are described. A one dimensional model of this kind of element is formulated, and the effects of coupling between element resonant modes are examined. GRA

N80-23580# California Univ., Berkeley. Lawrence Berkeley Lab. Engineering and Technical Services Div.
LOW-NOISE WIDE-BAND AMPLIFIER SYSTEM FOR STOCHASTIC BEAM COOLING EXPERIMENTS
Branko Leskovar and C. C. Lo Oct. 1979 11 p refs Presented at the IEEE Nucl. Sci. Symp., San Francisco, 17 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9841; CONF-791037-15) Avail: NTIS HC A02/MF A01

A low noise wideband power amplifier system was developed for stochastic beam cooling experiments. The system incorporated a low noise preamplifier with a noise figure of 1.9 dB over a bandwidth range of 20 to 300 MHz, wideband driver and buffer stages, a frequency characteristics shaping network, a remotely controlled wideband attenuator with 0.1 dB resolution, a remotely controlled high resolution adjustable delay line, and a wideband solid state output power amplifier. The amplifier system had a maximum voltage gain of 140 dB over a bandwidth from 1.5 to 310 MHz, a signal group delay of 55.5 ns, and a c.w. output power level of 75 W. Particular attention was given to minimizing the signal propagation time delay of the amplifier system, the propagation time delay change as a function of the system gain, and harmonic and intermodulation distortion. DOE

N80-23581# Princeton Univ., N. J. Plasma Physics Lab.
CURRENT GENERATION WITH LOW-FREQUENCY WAVES
N. J. Fisch and C. F. F. Karney Dec. 1979 58 p refs
(Contract EY-76-C-02-3073)
(PPPL-1624) Avail: NTIS HC A04/MF A01

The low frequency waves most suitable for operating tokamak reactors in the steady are identified in terms of the power cost for deployment in a reactor. Means of exciting these waves and tradeoffs with design critieria are discussed. A comparison is made with the alternative attractive regime of high-frequency waves. Conclusions are based, in part, on the numerical solution of the two dimensional Fokker-Planck equation with an added quasi-linear term due to the waves. DOE

N80-23582# Sandia Labs., Albuquerque, N. Mex. Telemetry Components and Transducers Div.
CHARACTERIZATION OF DIGITAL FILTERS USED IN SANDIA LABORATORIES TEST DATA ANALYSIS DIVISION
Patrick L. Walter and Ronald Rodeman Dec. 1979 56 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1230) Avail: NTIS HC A04/MF A01

Characteristics of computer synthesized digital filters are presented. Difficulties with such filters discussed include deviation from both flat amplitude and linear phase response, time delay, pulse stretching, periodicity of and nonuniqueness of the transfer function, and zero phase filters. E.D.K.

N80-23583# Sandia Labs., Albuquerque, N. Mex.
LATCH-UP CONTROL IN CMOS INTEGRATED CIRCUITS
A. Ochoa, W. Dawes, and H. Packard 13 Jul. 1979 13 p refs Presented at the 1979 IEEE Ann. Conf. on Nucl. and Space Radiation Effects, Santa Cruz, Calif., 17 Jul. 1979
(Contract EY-76-C-04-0789)
(SAND-79-1479C; CONF-790706-7) Avail: NTIS HC A02/MF A01

The potential for latch-up, a p-n-p-n self-sustaining low impedance state, in standard bulk complementary metal oxide semiconductor (CMOS)-integrated circuit structures is discussed. Latch-up control methods presently employed for weapons and space applications on present (approx. 9 microns p-well) CMOS are surveyed and the extent of their applicability to increased packing density designs is examined. DOE

N80-23584# Sandia Labs., Livermore, Calif. Combustion Applications Div.
CRITICAL COMPARISON OF HOT-WIRE ANEMOMETRY AND LASER DOPPLER VELOCIMETRY FOR I.C. ENGINE APPLICATIONS
O. P. Witze Sep. 1979 30 p refs Presented at SAE Automotive Eng. Congr., Detroit, 25 Feb. 1980 Sponsored in part by Motor Vehicle Manufacturers Association of America
(Contract EY-76-C-04-0789)
(SAND-79-8685; CONF-800202-1) Avail: NTIS HC A03/MF A01

Hot-wire anemometer and laser Doppler velocimeter measurements taken in a motored reciprocating engine are compared to access the validity of hot-wire measurements. The procedure used to account for the sensitivity of the hot wire to changes in the gas temperature is extensively investigated. For the optimum conditions of known flow direction, low turbulence level, and low compression ratio, the hot-wire anemometer can provide useful mean velocity results. Accurate hot-wire turbulence intensity measurements appear to be possible only for the intake and exhaust strokes. DOE

N80-23585# AEG-Telefunken, Berlin (West Germany). Forschungsinst.
DEVELOPMENT OF CURRENT CONVERTERS FOR SWITCHING AND REGULATING TASKS IN ENERGY TECHNOLOGY Final Report
Hans-Peter Beck, Peter Heinmeyer, Detlef Knuth, Werner Lukanz, and Monika Steinwegs Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 350 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-T-79-12) Avail: NTIS HC A15/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 73,10

The design and production of semiconductor switching devices are described. The devices serve as semiconductor power switches in current converting and current regulating applications. Two prototypes were developed, a power switch for 10 MW with a water cooling system and a power switch for 3 MW with an evaporative cooling system. Author (ESA)

N80-23586# Technische Universitaet, Brunswick (West Germany). Inst. fuer Geophysik und Meteorologie.
THERMAL AND CRYOTECHNICAL DEFINITION STUDY ON MINICRYOGENERATOR SYSTEM FOR SPACE APPLICATION (SQUID MAGNETOMETER) Final Report
Guenter Musmann, Reinhardt Geisler, Peter Burkert (Kayser Threde G.m.b.H.), Reinhard Katterloher (Firma Reinhard Katterloher), and

Martin Pfeil (Firma Martin Pfeil) Bonn Bundesmin. fuer Forsch. und Technol. Jun. 1979 134 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-W-79-01) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 27.75

The cryogenic cooling requirements for a superconducting quantum interference device (SQUID) to measure magnetic fields under space laboratory conditions are studied. The necessary cooling capacity is calculated and different technical concepts for the cryogenerator system and its components are developed. Some critical results of the study were verified by tests. Author (ESA)

N80-23587# AEG-Telefunken, Heilbronn (West Germany). Geschaeftsbereicht Halbleiter.

TECHNIQUES FOR LOW NOISE AND HIGH POWER TRANSISTORS IN INTEGRATED CIRCUITS Final Report

Kurt Dieter Hintzman Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 110 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. (BMFT-FB-T-79-15) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 22.70

The development of low noise transistors and high power transistors in integrated circuits is described. The optimized production process and an additional gettering step are described. The application of polycrystalline regions as collector contacts is discussed. Author (ESA)

N80-23588# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

RESEARCH ON THE PERTINENT PARAMETERS OF A QUARTZ OSCILLATOR Thesis - Univ. Pierre et Marie Curie

Francois Tardivel 1979 131 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-636) (ONERA-NT-1979-10; ISSN-0078-3781) Avail: NTIS HC A07/MF A01

A quartz operational cascade type oscillator is considered. A diode limiter device and a feed back loop made of a band filter that selects the desired quartz overtone are included. A computing method is described which allows the elaboration of a mathematical model simulating the working of the oscillator. The model accounts for a number of non linearities introduced by the transistors, the diodes, and the quartz resonator. This model permits the determination of the sensitivity to a score of parameters of the frequency of the oscillator and proves the important part played by the band filter of the feedback loop, the electric coupling of the filter, and the diode limiter device in the instability of the oscillator frequency. In order to minimize the contribution of electronics in this instability at medium and long term, a modification of the structure of the feedback loop is proposed. Author (ESA)

N80-23589# Oxford Univ. (England). Dept. of Engineering Science.

DESIGN OF STOCHASTIC DISCRETE-TIME LINEAR OPTIMAL REGULATOR

K. P. Lam 1979 53 p refs (OUEL-1288/79) Avail: NTIS HC A04/MF A01

Methods of designing optimal digital regulators for randomly distributed single input/single output linear systems with time delay are presented. The approach forms an extension to minimum variance and single stage cost function design and provides a link between them using state-space theory. Two state-space models, referred as implicit and explicit delay forms, are considered and their relationships with the standard single stage cost function design are established. Computational procedures and comparison between the state-space designs are provided. Author (ESA)

N80-23590# Oxford Univ. (England). Dept. of Engineering Science.

A SURVEY OF THE HIGH FREQUENCY EFFECTS ASSOCIATED WITH THE LIGHTNING DISCHARGE

N. S. J. Braithwaite and M. J. Cooke 1979 47 p refs (OUEL-1290/79) Avail: NTIS HC A03/MF A01

The literature on high frequency effects associated with the lightning discharge is reviewed, with emphasis on the possible hazards to aircraft from electromagnetic fields. Sources of fast field changes in the cloud discharge and in the discharge to ground are considered in detail, from experimental observations of the far radiation field. Radiation from the return stroke and from K changes is most important up to 10 MHz, and breakdown processes become important at higher frequencies. An overall amplitude frequency spectrum is given. Models of the return stroke are briefly reviewed. Measurements at lightning current at ground are discussed, with the airborne survey of lightning fields conducted as part of TRIP-76. Author (ESA)

N80-23591# Bureau of Reclamation, Denver, Colo. Electric Power Branch.

FIELD TESTS OF THE LIBERTY-MEAD TRANSMISSION SYSTEM

L. E. Eilts Aug. 1979 61 p refs (PB80-125610; REC-ERC-79-9) Avail: NTIS HC A04/MF A01 CSCL 09C

Results of field tests of a 383 km (238 mi), 345 kV, series-capacitor-compensated transmission line are summarized. The test series included routine capacitor bypass and insertion tests, line switching tests, and staged fault tests. The tests demonstrated that routine capacitor bypass and insertion do not adversely affect the power system; line switching surges are modest, but reclosing, using the existing switchgear, is precluded by trapped charge; high-speed capacitor bypass was achieved but reinsertion proceeded slower than permitted by the specifications; breaker interrupting performance was acceptable; and, excepting some minor problems that were identified, the line relaying schemes generally performed satisfactorily. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N80-23582 Stanford Univ., Calif.

THE THERMAL AND HYDRODYNAMIC BEHAVIOR OF THICK, ROUGH-WALL, TURBULENT BOUNDARY LAYERS Ph.D. Thesis

Phillip Meredith Ligrani 1980 251 p
Avail: Univ. Microfilms Order No. 8011864

Thick, fully rough, and transitionally rough turbulent boundary layers were studied in order to investigate the differences between fully rough and transitionally rough behavior and to observe how downstream development affects these flows as the boundary layers become very thick. Measurements included Stanton numbers, skin friction coefficients, mean temperature and velocity profiles, Reynolds stress tensor component profiles, and spectra of the longitudinal velocity fluctuations. Predictions of wall heat transfer, wall shear, and mean profiles were made using a mixing-length and turbulent Prandtl number closure scheme which accounted for the effects of wall roughness in the boundary layer equations. Dissert. Abstr.

N80-23583 Brown Univ., Providence, R. I.

ON THE ORGANIZED LARGE-SCALE STRUCTURE IN A TURBULENT ROUND JET AND ITS FAR-FIELD SOUND Ph.D. Thesis

Reda Rushdi-El Mankbadi 1979 325 p
Avail: Univ. Microfilms Order No. 8007040

The large scale organized structure observed in the initial region of a round jet is investigated. Phase averaging, in addition to the usual time averaging, decomposes each flow quantity into three flow components: a mean one, a wavelike large scale structure one, and a fine grained turbulent one. After making certain assumptions concerning the shape of each flow component, the integrated energy equations are solved, yielding the wave amplitude, the fine-grained turbulence energy, and the mean flow

momentum thickness. Considering the organized structure to be more efficient than the random turbulence in emitting sound, the noise of a subsonic cold turbulent round jet is investigated. The organized structure was found to generate noise of comparable magnitude to the measured values of the full noise. The spectra of the organized structure noise were found to peak at the same Strouhal number at which the measured sound intensity peaks. The far field sound of a turbulent plane mixing layer is investigated by taking the organized fluctuations of the turbulent flow to be the dominant sound source. Lighthill's stress tensor is determined and the volume integral involved in Lighthill's equation is evaluated to yield the far field sound produced by the large scale organized structure. Results show that the organized structure radiates shear noise of considerable magnitude.
Dissert. Abstr.

N80-23594 Stanford Univ., Calif.
FINITE ELEMENT SIMULATION OF SIMPLE THREE-DIMENSIONAL FULLY CAVITATING FLOWS Ph.D. Thesis
Peter Yuk-Lam Ko 1980 123 p
Avail: Univ. Microfilms Order No. 8011660

A formulation is given for three dimensional fully cavitating flow with a Riabouchinsky model based on potential flow theory. The model is nonlinear and the location of the free surface of the cavity is not known priori. Therefore, an iterative procedure is used to locate the free surface boundary. The employment of a trial-free-boundary approach effectively reduces the fully nonlinear model to a linear one, and the solution at each iteration is obtained by means of the finite element method (FEM). Examples studied were fully cavitating flow past flat plates in a water tunnel. Results are given for pure drag flows past circular and elliptic plates and a lifting flow past a circular plate. Because of the change in flow boundary conditions at the separation edge and the failure of the FEM to resolve these conditions accurately, the ability of the numerical solution to maintain a constant pressure over the entire cavity decreases as the three dimensionality of the free surface increases. However, the present procedure produces absolutely stable iterations and shows no sign of drifting of the free surface. Dissert. Abstr.

N80-23595 Wayne State Univ., Detroit, Mich.
STABILITY OF MODULATED ROTATING FLUIDS Ph.D. Thesis
Jerry Ihor Tustaniwskyj 1979 183 p
Avail: Univ. Microfilms Order No. 8010180

The linear and energy stabilities of an extensively modulated cylindrical Couette flow were investigated in the finite gap range. A closed form analytic solution is obtained for the basic unsteady flow, with the modulation introduced through the boundary conditions. In the linear analysis, perturbation equations are derived and subsequently solved via the Galerkin method with the stability analyzed using the Floquet theory. Instabilities due to two dimensional axisymmetric disturbances are thoroughly investigated and results are found to compare favorably with experimental ones. Some arbitrary three dimensional non-axisymmetric disturbances are also studied and are found to be of importance especially at higher frequencies. In the energy analysis, the Euler-Lagrange equations are derived using variational techniques and are solved using the Galerkin method again. The strong energy results, where two dimensional axisymmetric disturbances are found to be the most crucial ones, are quite conservative, thus creating a rather large region where subcritical instabilities are possible.
Dissert. Abstr.

N80-23596 Iowa State Univ. of Science and Technology, Ames.
THE SPLIT COEFFICIENT MATRIX METHOD FOR HYPERBOLIC SYSTEMS OF GASDYNAMIC EQUATIONS Ph.D. Thesis
Sukumar Raman Chakravarthy 1979 111 p
Avail: Univ. Microfilms Order No. 8010220

A finite difference method, the split coefficient matrix (SCM) method, for the numerical solution of hyperbolic systems of gasdynamic equations is presented. The method retains the ease of application of conventional finite difference schemes while exploiting the mathematical theory of characteristics and thus proves to be a superior method. The development of the method from characteristics theory is presented in detail. Boundary point calculation procedures along the lines of and consequently consistent with the SCM method used at interior points are explained. The split coefficient matrices that define the method are given for unsteady and steady supersonic flows, for several choices of dependent variables and for the Cartesian and cylindrical base coordinates systems.
Dissert. Abstr.

N80-23597 New York Univ., N. Y.
A CLASS OF COMPRESSIBLE PARTIAL DIFFERENTIAL EQUATIONS RELATED TO THE INCOMPRESSIBLE NAVIER-STOKES EQUATION Ph.D. Thesis
John Edward Weiss 1979 189 p
Avail: Univ. Microfilms Order No. 8010412

A class of compressible extensions of the Navier Stokes equation were defined that depend on a linear operator which is required to posses a formal inverse and is otherwise arbitrary that the solutions of the compressible extension are continuous functions of a parameter and converge uniformly to the solution of the Navier Stokes equation when this parameter converges to zero. Compressible and incompressible components of the velocity field, the Markov random coupling model (MRCM) for this compressible extension was constructed to determine the quantitative nature of the interactions between the compressible and incompressible components of the velocity field. The MRCM equations were examined analytically. Results indicate that it is possible to apply closure methods with a compressible extension to study the interaction of a near incompressible flow with a compressible component.
Dissert. Abstr.

N80-23598 Stanford Univ., Calif.
THE EFFECTS OF PHONON DYNAMICS ON THE SINGULAR BEHAVIOR OF A ONE-DIMENSIONAL FERMI GAS Ph.D. Thesis
Edward Hovsepian Rezayi 3 May 1980 134 p
Avail: Univ. Microfilms Order No. 8011698

Phonon dynamical effects are investigated for two model systems of fermion-phonon interactions. The first model is a Tomonaga-Luttinger model generalized to include forward scattering fermion-phonon interactions. For a certain range of the coupling constants, the model is solved exactly. The method of solution is a direct diagonalization of the Hamiltonian in the space of the Tomonaga bosons. Bosonization of Fermi fields is used to obtain the single-particle propagator, and the charge-density wave (CDW) and superconducting (SUP) response functions. A CDW occurs for regions of repulsive direct fermion-formions interactions. The bulk of phase space for which the SUP instability occurs lies within the region of attractive fermion-fermion interactions. The second model studied is the Frohlich Hamiltonian which includes backscattering of fermions by phonons. This model is investigated by employing a low-type renormalization group. The scaling equations are obtained in the parquet (one-loop) approximation, and are found to be identical to that of the nonretarded model. The phonon dynamics, however, affect the correlation functions, which are also obtained in the parquet approximation.
Dissert. Abstr.

N80-23599*# Sigma Research, Inc., Richland, Wash.
TWO-PHASE WORKING FLUIDS FOR THE TEMPERATURE RANGE OF 50 TO 350 DEG, PHASE 2 Final Report
E. W. Saaski and J. H. Hartl Mar. 1980 57 p refs
(Contract NAS3-21202)
(NASA-CR-159847) Avail: NTIS HC A04/MF A01 CSCL 20D

Several two phase heat transfer fluids were tested in aluminum and carbon steel reflux capsules for over 25,000 hours at temperatures up to 300 C. Several fluids showed very good stability and would be useful for long duration heat transfer applications over the range 100 to 350 C. Instrumentation for the measurement of surface tension and viscosity were constructed for use with heat transfer fluids over the temperature range 0 to 300 C and with pressures from 0 to 10 atmospheres. The surface tension measuring device constructed requires less than a 1.0 cc sample and displays an accuracy of about 5 percent in preliminary tests, while the viscometer constructed for this program requires a 0.05 cc sample and shows an accuracy of about 5 percent in initial tests.
E.D.K.

N80-23600*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

MEASURED AND PREDICTED SHOCK SHAPES AND AERODYNAMIC COEFFICIENTS FOR BLUNTED CONES AT INCIDENCE IN AIR AT MACH 5.9

Robert L. Calloway and Nancy H. White May 1980 70 p refs

(NASA-TP-1652; L-13429) Avail: NTIS HC A04/MF A01 CSCL 20D

Experimental values of shock shapes (angles of attack of 0 deg and 10 deg) and static aerodynamic coefficients (angles of attack of -4 deg to 12 deg for sharp and spherically blunted cones having cone half angles of 30 deg, 45 deg, 60 deg, and 70 deg, and nose bluntness ratios of 0, 0.25, and 0.50 are presented. Shock shapes were measured at 0 deg angle of attack by using a flat faced cylinder (90 deg cone) and a hemispherically blunted cylinder (sphere). All tests were conducted in air at a free stream Mach number of 5.9 and a unit free stream Reynolds number of 2,800,000 per meter. Comparisons between measured values and predicted values were made by using several numerical and simple engineering methods. Author

N80-23601# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

SHOCK-BOUNDARY LAYER INTERACTION EFFECTS IN TRANSONIC FLOW FIELDS Final Report, 1972 - 1979

G. R. Inger 25 Jan. 1980 30 p refs

(Contract N00014-75-C-0456)

(AD-A080889; VPI-SU-Aero-105) Avail: NTIS HC A03/MF A01 CSCL 20/4

This report summarizes the results of a five-year basic theoretical study of non-separating transonic shock-turbulent boundary layer interactions. Both local and downstream boundary layer distortion effects have been studied including extensive comparisons with available experimental data. GRA

N80-23602# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Engineering Science and Mechanics.

ON GOERTLER INSTABILITY

Saad Aly Ragab and Ali Hasan Nayfeh Dec. 1979 81 p refs

(Contract N00014-75-C-0381)

(AD-A081255; VPI-E-79-41) Avail: NTIS HC A05/MF A01 CSCL 20/4

Goertler instability for boundary-layer flows over generally curved walls is considered. The full linearized disturbance equations are obtained in an orthogonal curvilinear coordinate system. A perturbation procedure to account for second-order effects is used to determine the effects of the displacement thickness and the variation of the streamline curvature on the neutral stability of the Blasius flow. The pressure gradient in the mean flow is accounted for by solving the non-similar boundary-layer equations. Growth rates are obtained for the actual mean flow and compared with those for the Blasius flow and the Falkner-Skan flows. The results demonstrate the strong influence of the pressure gradient and the nonsimilarity of the basic flow on the stability characteristics. GRA

N80-23603# Toronto Univ., Downsview (Ontario). Inst. for Aerospace Studies.

APPLICATIONS OF RANDOM-CHOICE METHOD TO PROBLEMS IN SHOCK AND DETONATION-WAVE DYNAMICS Interim Report

T. Saito and I. I. Glass Oct. 1979 78 p refs

(Grant AF-AFOSR-3303-77; AF Proj. 2307)

(AD-A081304; UTIAS-240; AFOSR-80-0144TR) Avail: NTIS HC A05/MF A01 CSCL 20/4

Eight applications of the Random-Choice Method (RCM) to the solution of problems in shock and detonation-wave dynamics are presented. It is shown that unlike other numerical methods, the RCM yields sharp-fronted shocks and contact surfaces without resorting to artificial and perhaps erroneous means of predicting their locations. It has been shown by examples that the RCM provides exceptionally high computational accuracy for flows involving planar and spherical shock waves, rarefaction waves and contact surfaces, as well as their interactions. In addition, the RCM can handle flows with detonations and chemical reactions involving the above transition fronts. GRA

N80-23604# Pennsylvania State Univ., University Park. Applied Research Lab.

A HIGHER ORDER SURFACE SINGULARITY METHOD FOR THE AXISYMMETRIC INVERSE PROBLEM

J. Fernandez 25 Jun. 1979 45 p refs

(Contract N00024-79-C-6043)

(AD-A081797; ARL/PSU-TM-79-125) HC A03/MF A01 CSCL 20/4

The hydrodynamic design of the axisymmetric body with certain performance characteristics requires the solution to the inverse problem wherein the pressure distribution on the body is specified and the corresponding body profile must be determined. This paper presents an efficient inverse method for incompressible, axisymmetric potential flows employing a higher order surface singularity technique with parabolic surface elements and linearly varying sources. The body shape is obtained through an iterative scheme using the stream function to predict the body profile. The method is rapidly convergent and shows excellent agreement in cases where solutions are known. GRA

N80-23605# Nielsen Engineering and Research, Inc., Mountain View, Calif.

DEVELOPMENT OF PERTURBATION PROCEDURES FOR NONLINEAR INVISCID AND VISCOUS FLOWS Interim Report, 1 Apr. - 30 Sep. 1979

David Nixon Jan. 1980 105 p refs

(Contract F49620-79-C-0054; AF Proj. 2307)

(AD-A081531; NEAR-TR-214; AFOSR-80-0129TR) Avail: NTIS HC A06/MF A01 CSCL 20/4

The perturbation theory for transonic flow is further developed for two and three dimensional problems. The physical perturbation theory, in which the perturbation parameter is a physical quantity, is applied to solutions of the Navier-Stokes equations in two dimensions. The mathematical perturbation theory, in which the perturbation parameter is a measure of the difference between approximate and exact solutions, is applied both to the three dimensional potential flow problems and to the two dimensional Navier-Stokes equations. The strained coordinate technique is used to treat changes in location of any shock waves or large gradients. GRA

N80-23606# Naval Postgraduate School, Monterey, Calif.

HYDROELASTIC OSCILLATIONS OF SMOOTH AND ROUGH CYLINDERS IN HARMONIC FLOW Ph.D. Thesis

Farhad Rajabi Dec. 1979 297 p refs

(AD-A081760) Avail: NTIS HC A13/MF A01 CSCL 20/4

A comprehensive experimental and analytical investigation has been undertaken to determine the hydroelastic response of elastically-mounted smooth and rough cylinders in harmonically-oscillating flow. The forces acting on the cylinder and the cylinder response have been measured together with the characteristics of the flow and analyzed through the use of the Fourier analysis, spectral analysis, Duhamel's integral, and the wake-oscillator model. In addition, the in-line force has been analyzed through the use of Morison's equation. The results have shown that hydroelastic oscillation occur in a narrow range of the reduced velocity and give rise to significant amplification of the exciting force. The use of the Fourier and spectral analysis together with the governing equations of motion was shown to predict the hydroelastic response of the cylinders in the synchronous region. The investigation shed considerable light on the interaction between the harmonic fluid motion and the hydroelastic response of cylinders and provided definitive information for the prediction of the force and response characteristics of the type of oscillations considered herein. GRA

N80-23607# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.

ON THE INTERACTION OF WALL JETS AND FOUNTAIN FORMATION Final Report

K. T. Yen 30 Sep. 1979 25 p refs

(AD-A081540; NADC-79275-60) Avail: NTIS HC A02/MF A01 CSCL 20/4

An analysis of the fountain formation produced by the vertical impingement of two jets on a flat-ground surface is presented. A method has been developed for the determination of the upwash angle of the fountain in the plans of symmetry and the ground stagnation line. Comparison of the calculated results from the present analysis with tests data obtained by the Grumman Aerospace Corporation shows generally good agreement. The different methods of approach and results in some recent works

regarding the upwash angle are discussed, and it is shown that the fountain should leave the ground surface in direction perpendicular to it, and approach the upwash angle asymptotically. GRA

N80-23608# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
PREDICTION OF SEPARATING TURBULENT BOUNDARY LAYERS INCLUDING REGIONS OF REVERSED FLOW Final Report
R. H. Pletcher, O. K. Kwon, and R. Chilukuri Feb. 1980 71 p refs
(Grant DAAG29-76-G-0155)
(AD-A081592; ISU-ERI-AMES-80112; HTL-22; ARO-13376.4-E) Avail: NTIS HC A04/MF A01 CSCL 20/4

The results of a research program to develop and evaluate improved prediction methods for turbulent separating flows are summarized. The predictions of several turbulence models have been compared with experimental data for flows containing regions of recirculation using an inverse finite-difference method to solve the boundary layer equations. A new turbulence model which employs a one-dimensional transport equation for the outer-layer length scale was seen to provide the best agreement with the experimental data beyond separation. A viscous-inviscid interaction calculation procedure was developed to predict airfoil flows containing leading edge or midchord separation bubbles. The procedure utilized the inverse finite-difference method to predict the viscous flow and a small disturbance Cauchy integral formulation for the inviscid flow. Three models for laminar-turbulent transition were evaluated. Generally good agreement between predictions of the best model and measurements was observed in the several comparisons made. Some early results from a finite-difference scheme to solve the partially parabolized Navier-Stokes equations in primitive variables were also reported. The method was developed to predict viscous flows in which normal pressure gradients cannot be neglected. GRA

N80-23609# Defence Research Establishment Suffield, Ralston (Alberta).
A CALCULATION METHOD FOR CONVECTIVE HEAT AND MASS TRANSFER IN MULTIPLY-SLOTTED FILM-COOLING APPLICATIONS
S. B. Murray Jan. 1980 91 p refs
(AD-A081641; DRES-TP-507) Avail: NTIS HC A05/MF A01 CSCL 20/4

A computer model to calculate the development of wall jet boundary layers downstream of multiple film-cooling slots is described. The differential equations for the conservation of mass, momentum and energy in an incompressible two-dimensional or axisymmetric flow are solved using a downstream-marching, iterative, implicit, finite-difference scheme. The turbulent transport of mass in a conventional wall boundary layer is described by means of inner outer two layer eddy viscosity model based on the Prandtl mixing-length hypothesis with Van Driest's modification in the near-wall region. Further alterations to include the effects of pressure gradients, heat and mass transfer are due to Cebeci and Smith. This basic model is extended to include cases with tangential fluid injection. Computed velocity profiles indicate that the law of the wall is obeyed in the inner layer and that the outer wake-like layer strives to resume the velocity-defect relationship that existed upstream of the point of fluid injection in zero pressure-gradient flow with no heat or mass transfer. Comparison between computed and experimental adiabatic wall temperature distributions in flows with heat transfer shows that the eddy viscosity model is deficient in the near-slot region and tends to overestimate film-cooling efficiency. The absence of an eddy term to account for turbulence due to finite slot lip thickness is partly responsible for this overestimation. Recommendations are made to validate the model in pressure-gradient flows and to improve the predictive capability in the near-slot region. GRA

N80-23610# Tetra Tech, Inc., Pasadena, Calif.
COMPUTER PROGRAMS FOR CALCULATING PARTIALLY CAVITATING BLUNT TRAILING EDGED CASCADE FLOWS IN NONLINEAR THEORY Technical Manual, 15 Feb. - 31 Oct. 1979
Shin Maekawa and Okitsugu Furuya Jan. 1980 207 p
(Contract N00014-79-C-0234)
(AD-A081832; TETRAT-TC-3284-02) Avail: NTIS HC A10/MF A01 CSCL 09/2

In addition to the previously developed partially cavitating cascade theory, two new flow models were constructed in search of a better flow model for determining accurate force coefficients. Effort has been made for obtaining (1) physically acceptable flows, particularly the location of cavity boundary and (2) smooth matching of the flow characteristics between the partially cavitating and super-cavitating flow regimes. Based on the numerical results made with these flow models for practical blade profiles taken after a supercavitating propeller, it was found that no single flow model developed could handle the complete set of cascade geometries and incidence angles. One theory was supplemental to the other and no definite guideline was discovered for selection of an appropriate flow model for a specified flow condition to be solved except for a few weak evidences. This report is a users' manual for the computer programs developed above, describing the structure of program, input data set-up, typical output data and listing. GRA

N80-23611# Naval Postgraduate School, Monterey, Calif.
A PRIMITIVE VARIABLE MATHEMATICAL MODEL FOR PREDICTING THE FLOWS IN TURBOJET TEST CELLS Final Report
Charles Stevenson and David W. Netzer Oct. 1979 71 p refs
(AD-A081539; NPS-67-79-009) Avail: NTIS HC A04/MF A01 CSCL 21/4

An adaptation of a primitive variable, finite-difference computer program was made in order to predict the non-reacting flow fields in turbojet test cells. The study compares the predictions of the primitive variable computer model with an earlier stream function-vorticity computer model and empirical data. It was found that the model reasonably predicted the flow fields and allowed simulation of test cell flows up to full engine throttle conditions. GRA

N80-23612# Sandia Labs., Livermore, Calif. Thermal Sciences Div.
NATURAL CONVECTION HEAT TRANSFER FROM AN EXTERNAL RECEIVER
Dennis Siebers Dec. 1979 41 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8276) Avail: NTIS HC A03/MF A01

A numerical solution of turbulent, two dimensional, natural convection heat transfer for a high temperature, vertical surface is presented. This is relevant to heat transfer from the receiver power plant on a calm day (no wind). It is the lower bound of convective loss from an external receiver. Application of wall suction to the receiver surface is also examined as a means of reducing convective loss. An analysis of the economic impact of energy loss from a receiver is also presented. DOE

N80-23613# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
LAMINAR FLOW CYCLONE DEVELOPMENT PROGRAM Quarterly Technical Progress Report, 1 Oct. - 31 Dec. 1978
W. B. Giles and K. L. Bekofske Jan. 1979 9 p
(Contract ET-78-C-01-3242)
(FE-3242-2) Avail: NTIS HC A02/MF A01

The deleterious effects of turbulent mixing in the cyclone separation process were investigated. Transition from laminar to turbulent flow can be delayed to higher velocities and large scale by suppressing inlet turbulence and preventing boundary layer tripping. Extended laminarization can be obtained by techniques such as wall suction and wall cooling (in the case of gaseous flows). In cyclone separators, the flow must be set into a swirling motion to provide the separative g-field. The implications are that the flow entering the cyclone is unstable and that the swirl vane wake turbulence is the most probable trigger. The design of a model with greater contraction to suppress vane wake turbulence and a shorter radial inflow region to inhibit the development of the wall jet is proposed. An analysis of the boundary layer situation is suggested. DOE

N80-23614# California Univ., Berkeley. Lawrence Berkeley Lab.

MEASUREMENT OF THE THICKNESS OF LIQUID FILM BY MEANS OF CAPACITANCE METHOD
B. Leskovar, R. K. Sun, W. F. Kolbe, and B. Turko Nov. 1979 68 p refs
(Contract W-7405-eng-48; EPRI Proj. 1379-1)
(EPRI-NP-1212) Avail: NTIS HC A04/MF A01

A technique was developed for measuring water film thickness in a two phase annular flow system by means of the capacitance method. Theoretical considerations are applied to estimate the capacitance value as a function of the film thickness. An experimental model of the flow system with two types of electrodes mounted on the inner wall of a cylindrical tube was constructed and evaluated. The ability of the apparatus to observe fluctuations of the water film passing over the electrodes is described. DOE

N80-23615# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
INTERACTION OF TWO RING VORTICES WITH DIFFERENT TRANSLATION AXIS AND FORMATION OF NEW RING VORTICES FROM AN OSCILLATING RING VORTEX [DIE WECHSELWIRKUNG ZWEIER RINGWIRBEL VERSCHNEIDER TRANSLATIONSACHSEN UND DIE NEUBILDUNG VON RINGWIRBELN AUS EINEM SCHWINGENDEN RINGWIRBEL]
Peter E. M. Schneider Jun. 1978 108 p refs In GERMAN
(MPIS-2/1979) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 26,55

The merging, overtaking, and diffusion of two interacting ring vortices, successively formed at the same circular nozzle where the initial translational axis breaks down, is described. The same processes are studied for vortices meeting obliquely. The formation of new ring vortices from one vortex originating from nozzles of various shapes is explained. Photographic techniques using dyes in water were utilized. Author (ESA)

N80-23616# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
EXPERIMENTS WITH ROTATIONAL SYMMETRIC SUPERSONIC FREE JETS WITH LASER-INDUCED J2 FLUORESCENCE [UNTERSUCHUNGEN AN ROTATIONSSYMMETRISCHEN UEBERSCHALLFREISTRAHLEN MITTELS LASERINDUZIERTER J2-FLUORESZENZ]
Joachim Haegle Feb. 1979 78 p refs In GERMAN Original contains color illustrations
(MPIS-7/1979) Avail: NTIS HC A05/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 28,05

Using the J2 fluorescence process, supersonic free jets of low density were examined, including dissociation phenomena in the expansion region of the stream. Dissociation processes were also studied in the shocks. An argon laser was used. Author (ESA)

N80-23617# National Physical Lab., Teddington (England). Numerical Analysis and Computer Science Div.
DATA STRUCTURES FOR CALCULATING FLOWS IN STORM SEWER SYSTEMS
R. A. Pitfield Aug. 1979 12 p refs
(NPL-NACS-20/79) Avail: NTIS HC A02/MF A01

A mathematical model is presented which was used to calculate flows in storm sewer systems. The model is represented by a simple data structure. The operations on the data structure are described. Author (ESA)

N80-23618# Bristol Univ. (England). Dept. of Aeronautical Engineering.
DEVELOPMENT OF THREE-DIMENSIONAL TURBULENT BOUNDARY LAYERS IN INCOMPRESSIBLE FLOW WITH SEPARATION B.S. Thesis
M. I. Nissiriou and N. Pilatis Jun. 1979 58 p refs
(BU-239) Avail: NTIS HC A04/MF A01

The development of a three dimensional turbulent boundary layer was investigated in a non symmetrical diffuser. A yawmeter was calibrated and used to measure total pressures and angles of yaw over the twisted floor of the diffuser. Longitudinal pressure distributions, velocity profiles and viscous layer parameters were analyzed and compared with the results of an earlier two dimensional experiment. Lateral variables and parameters are presented and discussed. A swept separation front was defined and the flow beyond it is described. The establishment of equilibrium profiles in various parts of the flow is shown. Author (ESA)

N80-23619# Illinois Univ. at Urbana-Champaign. Water Resources Center.
JET INJECTIONS FOR OPTIMUM MIXING IN PIPE FLOW Final Research Report
S. D. Fitzgerald and E. R. Holley Dec. 1979 97 p refs Prepared for the Office of Water Research and Technol., Washington, D.C.
(PB80-128960; UILU-WRC-79-0144; WB0-02470; OWRT-A-091-ILL(1)) Avail: NTIS HC A05/MF A01 CSCL 20D

Laboratory experiments were conducted to determine the rates of mixing with a single jet injection made at the pipe wall at various angles relative to the pipe wall and with two diametrically opposed jets. For uniform pipe flow, it was possible to identify an optimum momentum for each angle of injection. A few experiments with induced swirl in the pipe flow showed that the swirl had a significant effect on the jet mixing, especially when two jets were used. GRA

N80-23620# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Propulsion and Energetics Panel.
TURBULENT TRANSPORT PHENOMENA
Marcel L. Barrere (ONERA, Paris) Feb. 1980 51 p refs
(AGARD-AR-150; ISBN-92-835-0259-0) Avail: NTIS HC A04/MF A01

Methods of making scalar measurements in hot turbulent flow and in combustion flow are examined. The advantages and drawbacks of employing either optical or probe methods for temperature measurements are outlined; for nonconstant concentration and density, spontaneous Raman scattering, methods making use of fluorescence perturbation phenomenon, and coherent anti-Stokes Raman scattering techniques are described. Finally, probe and indirect methods for pressure fluctuation measurements are suggested. M.G.

N80-24249 Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
UPDATE ON THE LOW WAVE NUMBER CONTENT OF TBL PRESSURE FIELDS
L. D. Pope *In* the Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 15-22 refs (For primary document see N80-24247 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washinton, D.C. 20375. Annual rate $100.00

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N80-23621*# Hughes Aircraft Co., Culver City, Calif.
CRYOGENIC COOLING STUDY FOR THE ADVANCED LIMB SCANNER
S. C. Russo May 1980 110 p
(Contract NAS1-16029)
(NASA-CR-159250) Avail: NTIS HC A06/MF A01 CSCL 14B

The cryogenic operating requirements for a VM refrigerator to be used for detector cooling of the advanced limb scanner (ALS) instrument are defined. Determination of these requirements include consideration of mission and environmental constraints. Based on the operating requirements a detailed refrigerator design and performance analysis is conducted resulting in an optimized VM refrigerator conceptual design. The cooler-instrument-

spacecraft interfaces are evaluated resulting in recommendations as to the best approach and most effective concepts resulting in simple and satisfactory interfaces. A preliminary implementation plan and schedule describing the general tasks required to develop, design, manufacture, test, and deliver three VM coolers and required support equipment to support an ALS flight experiment are presented. The result of this effort shows that existing VM cooler technology is sufficient to satisfy ALS mission requirements and schedules. M.G.

N80-23622# Defence Research Establishment, Ottawa. (Ontario). Defense Electronics Div.

VIDEO TAPE RECORDING TECHNIQUES FOR SEASAT RADAR DATA

L. G. Rowlandson and J. J. Renaud Dec. 1979 15 p
(AD-A081152; DREO-TN-79-32) Avail: NTIS HC A02/MF A01 CSCL 17/9

A dual channel ARVIN/ECHO WRR-441 video tape recorder was used in a system to record SEASAT radar data. The video recorder channels were limited to 6 MHz bandwidth whereas the radar data covered 20 MHz. By designing a phase quadrature recording/play back system an effective bandwidth of 12 MHz was realized which covered the main lobe of the sin X/X radar signal spectrum. GRA

N80-23623# Arizona Univ., Tucson. Inst. of Atmospheric Physics.

DUAL-FREQUENCY DOPPLER-LIDAR METHOD OF WIND MEASUREMENT Final Report, 1 Dec. 1975 - 30 Nov. 1979

Wynn L. Eberhard and Richard M. Schotland 22 Jan. 1980 37 p refs
(Grants DAAG29-76-G-0115; DAAG29-79-G-0026)
(AD-A080849; ARO-13343.1-GS) Avail: NTIS HC A03/MF A01 CSCL 14/2

In this new method (DFDL) of remote wind sensing, two optical beams of unlike frequency are superimposed in the sensed volume. The velocity information is obtained from the difference in the Doppler shifts of light scattered from the two beams by aerosols moving with the air. The DFDL signal spectrum and expressions for signal-to-noise ratio are derived. Attractive characteristics of DFDL include resiliance to optical imperfections of the turbulent atmosphere and a potential for simultaneous measurement of the three components of wind velocity. GRA

N80-23624# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.

A THERMOPLASTIC DEVICE FOR REAL-TIME IN SITU RECORDING OF ACOUSTICAL HOLOGRAMS

Hua-Kuang Liu (Alabama Univ., University) 1 Oct. 1979 54 p refs
(AD-A081011; DRSMI/RL-80-4) Avail: NTIS HC A04/MF A01 CSCL 20/1

Theory and experimental results of a thermoplastic device for real-time in situ acoustical holographic recording are presented. The theoretical analysis takes the possible existence of an in-line reference beam and its influence on the real-time coherent optical image reconstruction into consideration. A new technique has been used for fabricating the thermoplastic devices. The preliminary experimental data have demonstrated the feasibility of the application of the device for recordings of acoustical holograms. GRA

N80-23625# Army Missile Command, Redstone Arsenal, Ala. Ground Equipment and Missile Structures Directorate.

IMPROVING A REAL TIME ACOUSTICAL HOLOGRAPHIC SYSTEM FOR FLAW DETECTION

W. F. Swinson 1 Oct. 1979 35 p ref
(AD-A080918; DRSMI/RL-80-3) Avail: NTIS HC A03/MF A01 CSCL 20/1

This report documents work performed to improve the acoustical imaging capability of an acoustical holographic system for flaw detection. Included in the report is a mathematical model of the acoustical system and the results of the experimental effort to improve it. Added improvements include new plexiglas acoustical lenses, a lens gymbal mount, object gymbal mount, and acoustical thermoplastic memory. An attempt to use glycerine as a new acoustical couplant media is also reported. Work is also reported about the generation of acoustical real time speckle interferograms using the system. GRA

N80-23626# Litton Systems, Inc., Woodland Hills, Calif.

MULTIOSCILLATOR LASER GYRO STUDY Final Report, Sep. 1978 - Sep. 1979

V. E. Sanders Wright-Patterson AFB, Ohio AFAL Jan. 1980 64 p refs
(Contract F33615-78-C-1524; AF Proj. 2305)
(AD-A081421; AFAL-TR-79-1214) Avail: NTIS HC A04/MF A01 CSCL 17/7

Parameter variation experiments were conducted and results are reported on the Litton IR and D developed LG2432 multioscillator laser gyro. The purpose of this collection of data is in its intended use as an aid in the advancement of a developing multioscillator theoretical model. The model predicts both the output intensities and oscillation frequencies of the various ring laser modes in this device. Therefore, the parameter variation experiments are concerned with the intensities and frequencies of the laser modes as a function of several laser gyro environmental parameters. Results from the refined theory and the correlation with the experimental data are discussed. GRA

N80-23627# Massachusetts Inst. of Tech., Cambridge. Research Lab of Electronics.

PASSIVE RING RESONATOR LASER GYROSCOPE Final Report, 1 Jun. 1977 - 31 May 1979

Shaoul Ezekiel 3 Jan. 1980 17 p refs
(Grant AF-AFOSR-3042-76; AF Proj. 2305)
(AD-A081649; AFOSR-80-0134TR) Avail: NTIS HC A02/MF A01 CSCL 17/7

This report studies the behavior of a passive cavity optical gyroscope using (1) a small, 17 cm on a side, aluminum block and (2) a large, 70 cm on a side, cavity having discretely mounted components. In both cases, short-noise-limited performance has been reached for short periods of time, on the order of 20 minutes. Long term behavior has not been studied in much detail, but several factors that can influence the long term performance have been identified. GRA

N80-23628# Honeywell Electro-Optics Center, Lexington, Mass.

SPATIAL RADIOMETER, VOLUME 1 Final Report, 10 Nov. 1977 - 7 Sep. 1979

Richard Sullivan Mar. 1979 241 p
(Contract F19628-75-C-0179; AF Proj. 2123)
(AD-A081584; HONEYWELL-79024-Vol-1; AFGL-TR-80-0061-Vol-1) Avail: NTIS HC A11/MF A01 CSCL 17/5

This final report describes the Spatial Radiometer System, analysis, operational parameters and data results of the Head No. 1 system launch on 10 November 1977 at White Sands Missile Range, New Mexico. In addition, this final report contains the operational parameters and data on Head No. 2, thru 31 December 1978. Head No. 2 was not launched on 7 September 1978 due to pre-separation on the launch pad and is rescheduled for an early 1979 flight. GRA

N80-23629# California Univ., Livermore. Lawrence Livermore Lab.

BATTERY-POWERED, DIFFERENTIAL INFRARED ABSORPTION SENSOR FOR METHANE, ETHANE, AND OTHER HYDROCARBONS

G. E. Bingham, C. H. Gillespie, and J. H. McQuaid 8 Oct. 1979 21 p refs Presented at the Gas Res. Inst. Symp. on Methane Detection and Measurement, Chicago, 27 Aug. 1979
(Contract W-7405-eng-48; Grant NSF DEB-77-16327)
(UCRL-83317; CONF-790887-1) Avail: NTIS HC A02/MF A01

The performance goals, design considerations and physical details of the miniature infrared absorption sensor developed for the liquefied natural gas spill safety program are presented. The sensor is lightweight, battery-powered, portable, self-contained, and able to interface readily to large array data systems. Essentially a precision infrared differential spectrometer capable of operating over the full range of gas concentrations expected in the spill diffusion tests, the sensor is expected to cost less than $7000 per unit. The present design of this open-cell fast response sensor

allows it to measure two components, but it can be modified to measure additional components at a reduced sampling frequency. To minimize temperature effects and power consumption, the sensor has a single source, single detectors design which includes a rotating chopper-filter wheel. A CMOS microprocessor interfaced with a arithmetic chip is used to linearize sensor output and correct for component interference. DOE

N80-23630# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ORNL 10-m SMALL-ANGLE X-RAY SCATTERING CAMERA
R. W. Hendricks Dec. 1979 162 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6342) Avail: NTIS HC A08/MF A01

A new small angle X-ray scattering camera utilizing a rotating anode X-ray source, crystal monochromatization of the incident beam, pinhole collimation, and a two dimensional position sensitive proportional counter was developed. The design criteria for the instrument are outlined and an overview of the various components is given. A quantitative description of the performance of the system, and its use is illustrated with several examples taken from current research in materials and polymer science and biophysics. E.D.K.

N80-23631# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Dept.
NONCONTACT, LASER INTERFEROMETER SWEEP GAGE
W. E. Barkman 19 Nov. 1979 16 p ref
(Contract W-7405-eng-26)
(Y-2190) Avail: NTIS HC A02/MF A01

A noncontract rotary inspection machine was developed which utilizes a focused beam from a laser interferometer to measure variations in the surfaces of the reflective, spherical test parts used to characterize precision machines. Digital output data from the laser display is converted to an analog signal which is available for additional processing to provide contour and/or surface texture information. DOE

N80-23632# Oak Ridge National Lab., Tenn. Engineering Technology Div.
ASSESSMENT OF CURRENT HIGH-TEMPERATURE STRAIN GAGES
J. E. Smith Dec. 1979 59 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7025) Avail: NTIS HC A04/MF A01

Long term stability tests for systematic drift and strain sensitivity (gage factor) were conducted on two types of capacitive strain (gage) - the Boeing differential-capacitance gage and the CERL-Planer variable gap capacitive strain transducer and on the Ailtech SG-425 resistance gage. Results for tests of durations up to 12,000 hr are presented and compared with similar tests reported by others. The stability and repeatability of the capacitive systems were verified. In addition, two short term investigations were made on Ailtech weldable-resistance gages to address areas of uncertainty related to special applications. Data from these tests are also presented and interpreted. Advantages and limitations of the various systems are identified, and conclusions and recommendations are presented. Descriptions of the gage systems and problems encountered in the use of capacitive gages are given. DOE

N80-23633# California Univ., Livermore. Lawrence Livermore Lab.
STREAKCAMERA APERTURE FUNCTION
D. Dunbar 12 Dec. 1979 14 p
(Contract W-7405-eng-48)
(UCID-18520) Avail: NTIS HC A02/MF A01

The aperture function of a streaktube is derived. It defines the input spectrum as a function of time and space. The zeros of the aperture function depend inversely on aperture size and sweep time. DOE

N80-23634# Physics Lab. RVO-TNO, The Hague (Netherlands).
A SIMPLE CAMERA SYSTEM FOR PHOTOGRAPHY OF PROJECTILES IN FLIGHT UNDER DAYLIGHT CONDITIONS
A. W. M. vanderVoort Nov. 1978 97 p refs In DUTCH; ENGLISH summary
(PHL-1978-51; TDCK-71693) Avail: NTIS HC A05/MF A01

A modified Linhof camera with a two msec electromechanical shutter using a point light source with a flash interval of one microsecond was developed. Photography of projectiles in flight with a length of up to one meter and a velocity up to 1700 meters per second is possible. A retro reflector and high gain reflective sheeting were used. Silhouette and shockwave photographs are also possible. The use of a second flash unit permits photographs of the projectile body. Author (ESA)

N80-23635# National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.
GYRO NOISE MEASUREMENT AND ANALYSIS
J. A. Bosgra, J. J. M. Reumers, A. D. King (Ferranti Ltd., Edinburgh), G. Dickson (Ferranti Ltd., Edinburgh), and G. S. Gordon (Ferranti Ltd., Edinburgh) 12 Sep. 1979 177 p refs
(Contract ESA-3423)
(NLR-TR-79077-U; ESA-CR(P)-1295) Avail: NTIS HC A09/MF A01

Noise measurements were performed on two identical space qualified gyroscopes of the floated rate integrating type (Ferranti Type 125) in an analog rebalance loop configuration of selectable loop bandwidth, running under space representative conditions. The noise frequency range of interest was 0.005 Hz to 50 Hz. The noise results were processed into a number of statistical parameters (mean, standard deviation, range, slope, histogram). In addition, through a fast Fourier transform, auto and cross power spectra were determined together with auto and cross covariance functions. By making use of transfer function polynomials, equivalent gyro open-loop power spectra were computed from the closed-loop results and compared with directly measured open-loop spectra. A selection of the results is presented as graphs. Author (ESA)

N80-23636# Defence Research Information Centre, Orpington (England).
TORQUE RHEOMETERS, APPLICATION OF THE METHOD. PART 1: UNPLASTICIZED PVC
O. Laguna Castellanos, R. Arganza, and V. M. Arroyo London HMSO Nov. 1979 21 p refs Transl. into ENGLISH of Rev. de Plasticos Moderne, v. 29, no. 262, 1978 p 468-479 and 486
(DRIC-Trans-5585-Pt-1; BR71174-Pt-1) Avail: NTIS HC A02/MF A01

Parameters of a viscous material measured by a torque rheometer are correlated with shear stress and viscosity. The processing of an unplasticized polyvinyl chloride and the influence of external and internal lubricants was analyzed from the rheometer curves obtained on the material. Author (ESA)

N80-23520*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A POLARIMETER FOR THE HIGH RESOLUTION ULTRAVIOLET SPECTROMETER/POLARIMETER
John A. Calvert *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 303-310 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 14B

36 LASERS AND MASERS

Includes parametric amplifiers.

N80-23637# Rockwell International Corp., Thousand Oaks, Calif. Electronics Research Center.
LASER ANNEALING OF GaAs Final Technical Report, 5 Jan. 1978 - 30 Sep. 1979
F. H. Eisen, J. L. Tandon, and C. G. Kirkpatrick Jan. 1980 58 p refs
(Contracts MDA903-78-C-0285; MDA903-78-C-0463; ARPA Order 3595)
(AD-A081466; ERC-41008.11FR) Avail: NTIS HC A04/MF A01 CSCL 20/5

Irradiations of appropriate energy densities from a pulsed ruby laser lambda = 0.69 microns, tp approx. 15 or 59 ns) or

a pulsed electron beam (energy approx. 20 keV, t(p) approx. 100 ns) were found to anneal implanted amorphous layers in GaAs successfully without using an encapsulent. This was confirmed by backscattering/channeling and TEM measurements. Good electrical activation of high dose (greater than 10 to the 15th power sq. cm) implanted donor ions, with peak electron concentrations higher than 10 to the 19th power cc, was achieved after both pulsed ruby laser and pulsed electron beam irradiations. Low dose (less than 10 to the 13th power sq. cm) donor ion implanted samples irradiated with ruby laser or electron beam pulses did not show any measurable electrical activity. Possible reasons for this apparent inactivity were explored but the exact reasons are not clear at present. Au-Ge/Pt ohmic contacts with specific contact resistance as low as 10 to the -7th power omega/sq.cm were fabricated on n-type GaAs by pulsed electron beam alloying. This value of the specific contact resistance is one of the lowest values reported so far. GRA

N80-23638# Naval Postgraduate School, Monterey, Calif.
INDUCED EVAPORATION OF METAL FROM AN ALUMINUM SURFACE BY A NORMAL PULSE NEODYMIUM LASER M.S. Thesis
Christopher Brinton Johnson Sep. 1979 77 p refs
(AD-A081601) Avail: NTIS HC A05/MF A01 CSCL 20/5

Laser induced evaporation of material from the surface of an aluminum target in a vacuum was studied. Based on a literature examination, material removal using a normal pulse laser was judged to be more efficient than for a Q-switched laser. The experiment was conducted using a neodymium glass laser modified for normal pulse operation. The energy density was varied from 850 J/sq cm where no breakdown occurred to 5000 J/sq cm where the threshold for breakdown was exceeded. The normal pulse duration was 600 microsec. Analysis of the ejected material was achieved by using a Hughes Ionization Gauge placed in the path of the ejected material. Oscilloscope traces of the ionization gauge output show that the gauge 'sees' what is flying past it. There is good correlation between laser radiation, plasma radiation and ionization gauge fluctuations. The ionization gauge gave distinguishable signals for ions, electrons, and neutral particles ejected from the target surface. Signal sequence was dependent on the particle velocity. By measuring the elapsed time after ejection from the surface and the target to collector distance, the first arriving neutral particle velocity was determined to be 5.2 times ten to the 4th power cm/s. GRA

N80-23639# Naval Postgraduate School, Monterey, Calif.
INVESTIGATION OF VELOCITY FIELD ABOUT A TWO DIMENSIONAL PLEXIGLASS OGIVAL FOIL USING THE LASER DOPPLER ANEMOMETER M.S. Thesis
Gary J. Tettelbach Jun. 1978 135 p refs
(AD-A081765) Avail: NTIS HC A07/MF A01 CSCL 20/4

Until recently measuring the velocity of a fluid required the insertion of some instrument into the flow which would disturb the flow. The development of the laser doppler anemometer has created a means of measuring flow velocity using two intersecting monochromatic light beams, one of which has been shifted in frequency a prescribed amount. In order to use the type of laser doppler anemometer owned by M.I.T. the light beams must be able to traverse the test section and the scattered light be collected by the receiving optics. This requires a transparent model in order to measure the flow around the entire model. This thesis demonstrates the feasibility of such a method and is an account of the special techniques used to obtain the data. GRA

N80-23640# Boston Univ., Mass. Dept. of Chemistry.
MEDIUM EFFECTS OF FLUORESCENCE QUANTUM YIELDS AND LIFETIMES FOR COUMARIN LASER DYES Technical Report, 1 Nov. 1978 - 31 Oct. 1979
Guilford Jones, II, William R. Jackson, and Arthur M. Halpern (Northeastern Univ.) 1 Jan. 1980 13 p refs Submitted for publication
(Contract N00014-79-C-0054; NR Proj. 395-609)
(AD-A081748; TR-1) Avail: NTIS HC A02/MF A01 CSCL 07/4

Fluorescence quantum yields and lifetimes for a series of aminocoumarin laser dyes have been measured. The characteristics red shift of fluorescence in polar solvents is accompanied by a marked decrease in emission yield and lifetime for coumarins in which the substituted amine group at the 7 position is free to rotate. Strong emission is maintained in structurally rigid dyes. The non-radiative decay rates for non-rigid dyes which increase in polar solvents are associated with relaxation of emissive planar dye conformations to twisted zwitterionic species. GRA

N80-23641# Boston Univ., Mass. Dept. of Chemistry.
SOLVENT EFFECTS ON PHOTOPHYSICAL PARAMETERS FOR COUMARIN LASER DYES Technical Report, 1 Nov. 1978 - 31 Oct. 1979
Guilford Jones, II, William R. Jackson, Santhi Kanoktanaporn, and Arthur M. Halpern (Northeastern Univ.) 1 Jan. 1980 20 p refs Submitted for publication
(Contract N00014-79-C-0054; NR Proj. 395-609)
(AD-A081749; TR-2) Avail: NTIS HC A02/MF A01 CSCL 07/4

The red shifts of absorption and emission bands of coumarin laser dyes were studied as a function of solvent polarity and hydrogen bonding. Spectra were correlated with solvent parameters, pi and alpha, and those solvents resulting in the largest Stokes shifts of dye emission were identified. Solvent effects on emission yield and lifetime revealed a major non-radiative decay path for dyes in which the 7 amine function is free to adopt a non-planar conformation. GRA

N80-23642# Naval Postgraduate School, Monterey, Calif.
DESIGN CONSIDERATIONS OF A FLOW SYSTEM FOR TRANSIENT LASER DISCHARGE EXPERIMENTS
Josef Stricker Aug. 1979 37 p refs
(RR0000101)
(AD-A080942; NPS67-79-008) Avail: NTIS HC A03/MF A01 CSCL 20/5

Design considerations were examined for a flow system for transient electrical laser experiments. After a brief review of corona discharge gas flow interaction phenomena, the choice of the size and operating conditions of the discharge cell are discussed. Once those parameters are established, the flow system, which consists essentially of a Ludwieg tube, is designed. Attention is paid to flow starting times, to the available time of steady state flow, and to the effects of the boundary layer on the core flow. Suggested experiments and instrumentation are given in this report. GRA

N80-23643# Columbia Univ., New York.
HIGH PRESSURE NOBLE GAS ALKALI VAPOR MIXTURES AND THEIR VISIBLE AND INFRARED EXCIMER BANDS Final Report, 15 Nov. 1976 - 14 Nov. 1979
William Harper Feb. 1980 23 p refs
(Grant DAAG29-77-G-0015; DA Proj. 1L1-61102-BH-57)
(AD-A081808; ARO-1914223.8-P) Avail: NTIS HC A02/MF A01 CSCL 20/5

The infrared absorption of saturated alkali vapors has been measured for the first time. New absorption bands are tentatively assigned to triplet dimer molecules and also to trimer molecules. GRA

N80-23644# North Texas State Univ., Denton. Dept. of Physics.
INVESTIGATION OF LASER OPTICAL BIASING ON THE QUANTUM TRANSPORT PROPERTIES OF n-InSb Annual Summary Report, 1 Oct. 1978 - 30 Sep. 1979
David G. Seiler Oct. 1979 50 p refs
(Contract N00014-76-C-0319; NR Proj. 318-039)
(AD-A081578) Avail: NTIS HC A03/MF A01 CSCL 20/2

The interaction of CO2 and CO laser radiation with the semiconductor InSb has been studied at liquid helium temperatures with a highly sensitive photoconductive technique. Two distinct sets of resonant magnetophotoconductivity structure have been observed and identified as arising from multiphonon assisted cyclotron harmonic transitions and impurity level transitions. The first observation of a laser induced cooling process of the conduction electrons in n-InSb has been made using a CO laser and an applied dc electric field. GRA

N80-23645# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Sciences.
EXTENSION FOR INCREASED DATA COLLECTION OF

QUASI-HOMOGENEOUS SOURCES, ADDENDUM Progress Report, 1 Jul. - 30 Sep. 1979
Lorenzo M. Narducci 1 Feb. 1980 16 p
(Grant DAAG29-78-G-0098)
(AD-A081557; ARO-16054.2-A-P-ADD) Avail: NTIS HC A02/MF A01 CSCL 20/5

This report summarizes our experimental findings. It is divided into 3 sections: the first provides a general introduction to the main problem of quasi-homogeneous sources. The second section contains the important experimental findings from far field measurements. The third summarizes our efforts to perform near field coherence measurements. GRA

N80-23646# United Technologies Research Center, East Hartford, Conn.
PROGRAM TO INVESTIGATE ADVANCED LASER PROCESSING OF MATERIALS Annual Report, 1 Jun. 1978 - 31 Jul. 1978
E. M. Breinan, C. O. Brown, and D. B. Snow Aug. 1979 93 p refs
(Contract N00014-78-C-0387; ARPA Order 3542)
(AD-A077573; UTRC/R79-914346-4; AR-1) Avail: NTIS HC A05/MF A01 CSCL 20/5

During the course of the initial program year, UTRC's program to produce and spin test a 12.7 cm diameter turbine disk using the LAYERGLAZE (TM) process fabrication technique has seen major milestones met in both the processing and alloy Design areas. Specifically, in the processing area, a powder feed LAYERGLAZE apparatus has been designed, constructed, and used to produce LAYERGLAZE parts for mechanical test, and a 13.2 cm diameter, 3 cm thick scale model disk preform. Mechanical testing and microstructural analysis showed the LAYERGLAZED material to have excellent microstructure, along with good structural integrity and freedom from serious fabrication flaws. It thus appears that the process and the apparatus will be capable of producing test disks which will meet the program's major objective of a spin test in late 1980. In the alloy design area, a technique for effective, rapid screening of alloys for LAYERGLAZE fabricability has been devised. Early experience showed that all but the weakest of conventional superalloys crack under LAYERGLAZE fabrication conditions. Therefore, the alloy development task assumed the challenging role of identifying strong ductile alloys which are also fabricable by the LAYERGLAZE process. To date, a preliminary series of alloys based on the Ni-Al-Mo system has been identified, and one composition, Ni-8Al-12Mo-3Ta (at %) has been LAYERGLAZE fabricated and mechanically tested. GRA

N80-23647# State Univ. of New York, Buffalo. Dept. of Physics and Astronomy.
INTRACAVITY ABSORBER EFFECTS IN A CW DYE LASER Progress Report, 1 Jun. 1978 - 31 May 1979
G. O. Brink Feb. 1979 8 p refs
(Contract EG-77-S-02-4448)
(COO-4448-2) Avail: NTIS HC A02/MF A01

The technique of dye laser intracavity absorption was studied as a possible method of detecting small densities of atoms and molecules in combustion systems. Two types of phenomena were observed. Absorption signals, which, although of complex line shape, result in a decrease in laser intensity at the absorption wavelength are observed over a wide range of absorber densities. At values of the pump laser power above a certain threshold an enhancement effect is observed in which the dye laser spectrally condenses at the absorber wavelength. The enhancement effect allows the detection of very low densities of sodium with good signal to noise ratio. The data obtained to date are discussed. DOE

N80-23648# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL DESIGN FOR A LARGE FUSION LASER SYSTEM
C. A. Hurley 1 Nov. 1979 14 p refs Presented at the 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract W-7405-eng-48)
(UCRL-82928; CONF-791102-11) Avail: NTIS HC A02/MF A01

Progress is reported in the design, fabrication, and installation of laser chain components, the stable support structure that holds them, and the beam lines that transport the laser beam to the target system. Topics covered relating to the Nova laser system include configuration, spaceframe, beam line components, amplifiers, spatial filters, and cleanliness of the glass, mirrors and other surfaces. DOE

N80-23649# California Univ., Livermore. Lawrence Livermore Lab.
LASER-DRIVEN SHOCKWAVE EXPERIMENTS AT EXTREME HIGH PRESSURES
R. M. More 21 Sep. 1979 29 p refs Presented at the 5th Workshop on Laser Interactions with Matter, Rochester, N.Y., Nov. 1979
(Contract W-7405-eng-48)
(UCRL-83372) Avail: NTIS HC A03/MF A01

A quantitative analysis of the prospects for using laser-driven shockwave experiments to accurately determine equation of state data in the multimegabar pressure range is presented. In order to unambiguously interpret shockwave data, that is, a planar, steady shock wave entering cold material (without significant preheat perturbation) is required. The problems of attaining sufficiently clean shocks at high pressure are examined and scaling relations which relate the pressure achieved to laser intensity, pulse energy, etc, are developed. It is shown that significantly higher pressures can be achieved when structured (layered) targets are used. DOE

N80-23650# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF A LASER INTERFEROMETRIC DILATOMETER
W. D. Drotning 1979 32 p refs Presented at the 16th Intern. Thermal Conductivity Conf., Chicago, 7 Nov. 1979
(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)
(SAND-79-1714C; CONF-791134-6) Avail: NTIS HC A03/MF A01

The development of a high precision dilatometer using laser interferometry is described. Design criteria require operation over a temperature range from ambient to 900 K with a length change sensitivity of ten microinches (0.25 microns) or less. The dilatometer is designed to achieve rapid sample turnaround for quality control measurements in a production environment. The length change measurement is based on a modified Michelson interferometer using a two-frequency HeNe laser and ac detection of fringes. The final critical alignment of the interferometer during sample installation is achieved by automatic computer control. The furnance system incorporates a low thermal mass heating chamber to achieve rapid thermal response with minimal thermal disturbance to the interferometer system. Flexibility and reproductivity in heating schedules are achieved through digital control. Dilatometer control and data acquisition functions are accomplished by a minicomputer using a standard interface bus. DOE

N80-23651# Los Alamos Scientific Lab., N. Mex.
DIRECT SOLAR PUMPED LASER
Howard C. Volkin Jul. 1979 33 p refs
(Contract W-7405-eng-36)
(LA-7982-MS) Avail: NTIS HC A03/MF A01

The development of a direct solar pumped laser is described. Laser operation on the phosphorescence transition T reacts with S, with a suitable dye/solvent system is described. The set of coupled rate equations that governs the solar pumping kinetics are formulated. The compatability of the laser system with useful CW laser operation is discussed. DOE

N80-23652# Bureau of Radiological Health, Rockville, Md.
ANALYSIS OF SOME LASER LIGHT SHOW EFFECTS FOR CLASSIFICATION PURPOSES Final Report, Nov. 1979
David D. Royston Nov. 1979 25 p refs
(PB80-131576; FDA-80-8103; FDA/BRH-80/35) Avail: NTIS HC A02/MF A01 CSCL 20F

Some laser effects in laser lights shows irradiate audiences directly with laser radiation. This laser radiation must be below class 1 accessible emission limits. If actual radiometric measurements cannot be performed, a numerical analysis of the laser effect can be made to determine if the accessible laser

radiation is below acceptable limits. An analysis is presented of the following laser light show effects: a sawtooth wave scan, a triangular wave scan, a sine wave scan, a circular Lissajous pattern, a stationary laser beam on a rotating mirror ball, and a scanning laser beam on a mirror ball. The level of laser radiation of the effect is computed as well as the length of time the effect remains below class 1 levels. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N80-23653* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

FLOATING NUT RETENTION SYSTEM Patent

James F. Charles (Rockwell International Corp., Downey, Calif.) and Harry A. Theakston, inventors (to NASA) (Rockwell International Corp., Downey, Calif.) Issued 18 Mar. 1980 5 p Filed 31 Aug. 1978 Supersedes N78-32931 (16 - 23, p 3085) Sponsored by NASA

(NASA-Case-MSC-16938-1; US-Patent-4,193,435; US-Patent-Appl-SN-938582; US-Patent-Class-151-41.76) Avail: US Patent and Trademark Office CSCL 13I

A floating nut retention system includes a nut with a central aperture. An inner retainer plate has an opening which is fixedly aligned with the nut aperture. An outer retainer member is formed of a base plate having an opening and a surface adjacent to a surface of the inner retainer plate. The outer retainer member includes a securing mechanism for retaining the inner retainer plate adjacent to the outer retainer member. The securing mechanism enables the inner retainer plate to float with respect to the outer retainer number, while simultaneously forming a bearing surface for inner retainer plate.

Official Gazette of the U.S. Patent and Trademark Office

N80-23654* National Aeronautics and Space Administration. Pasadena Office, Calif.

QUARTZ BALL VALUE Patent

Carl Goetz (Motorola, Inc., Phoenix, Ariz.) and William M. Ingle, inventors (to NASA) (Motorola, Inc., Phoenix, Ariz.) Issued 1 Apr. 1980 6 p Filed 31 Aug. 1978 Supersedes N79-10427 (17 - 01, p 0057) Sponsored by NASA

(NASA-Case-NPO-14473-1; US-Patent-4,195,666; US-Patent-Appl-SN-938300; US-Patent-Class-137-625.4; US-Patent-Class-251-86; US-Patent-Class-137-375; US-Patent-Class-251-138) Avail: US Patent and Trademark Office CSCL 13K

A ball valve particularly suited for use in the handling of highly corrosive fluids is described. It is characterized by a valve housing formed of communicating segments of quartz tubing, a pair of communicating sockets disposed in coaxial alignment with selected segments of tubing for establishing a pair of inlet ports communicating with a common outlet port, a ball formed of quartz material supported for displacement between the sockets and configured to be received alternately thereby, and a valve actuator including a rod attached to the ball for selectively displacing the ball relative to each of the sockets for controlling fluid flow through the inlet ports.

Official Gazette of the U.S. Patent and Trademark Office

N80-23655* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

METHOD AND APPARATUS FOR HOLDING TWO SEPARATE METAL PIECES TOGETHER FOR WELDING Patent

Sidney R. McClure, inventor (to NASA) Issued 8 Apr. 1980 9 p Filed 6 Apr. 1978 Supersedes N78-23434 (16 - 14, p 1851)

(NASA-Case-GSC-12318-1; US-Patent-4,196,840; US-Patent-Appl-SN-894213; US-Patent-Class-228-212; US-Patent-Class-228-44.1R; US-Patent-Class-228-222; US-Patent-Class-269-287; US-Patent-Class-219-160; US-Patent-Class-219-161) Avail: US Patent and Trademark Office CSCL 13H

A method of holding two separate metal pieces together for welding is described including the steps of overlapping a portion of one of the metal pieces on a portion of the other metal piece, encasing the overlapping metal piece in a compressible device, drawing the compressible device into an enclosure, and compressing a portion of the compressible device around the overlapping portions of the metal pieces for holding the metal pieces under constant and equal pressure during welding. The preferred apparatus for performing the method utilizes a support mechanism to support the two separate metal pieces in an overlapping configuration; a compressible device surrounding the support mechanism and at least one of the metal pieces, and a compressing device surrounding the compressible device for compressing the compressible device around the overlapping portions of the metal pieces, thus providing constant and equal pressure at all points on the overlapping portions of the metal pieces. Official Gazette of the U.S. Patent and Trademark Office

N80-23656*# National Aeronautics and Space Administration, Washington, D. C.

ECONOMICAL DRIVE FOR LARGE TUBE MILLS BY MEANS OF PLANETARY GEARS

W. Ackle Mar. 1980 28 p Transl. into ENGLISH from Zem. -Kalk-Gips (West Germany), no. 1, 1975 p 43-50 Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75808) Avail: NTIS HC A03/MF A01 CSCL 13I

The performance of heavy-duty planetary gear drives for ball mills used in the cement industry since 1967 is described. These gear drives transmit up to 8500 HP per installation. A reliable method for establishing gear drive efficiency is described and possible savings due to higher efficiency are indicated. A.R.H.

N80-23657# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Power Systems Branch.

AN ANALYTICAL MEANS FOR DETERMINATION OF SCORING LIMITED LOAD CAPACITY IN SLIDING/ROLLING CONTACT Final Report, 1 Mar. 1977 - 27 Sep. 1979

Everett A. Lake Dec. 1979 23 p refs

(AF Proj. 3145)

(AD-A080984; AFAPL-TR-79-2128) Avail: NTIS HC A02/MF A01 CSCL 20/11

Scoring limited load capacity of paired discs in sliding/rolling lubricated contact is addressed. The approach used previously acquired data in a multiple regression analysis. The resulting mathematical expression for load capacity at failure has a correlation coefficient greater than 99%. GRA

N80-23658# Catholic Univ. of America, Washington, D. C. Vitreous State Lab.

EVALUATION OF THE TRACTION CHARACTERISTICS OF THREE LUBRICANTS Final Report, 1 Jan. - 31 Dec. 1978

C. J. Montrose, R. Moeller, D. Czaplak, B. Houston, R. R. Meiste, and P. Schoen (NRL, Washington, D.C.) Wright-Patterson AFB, Ohio AFML Mar. 1979 35 p refs

(Contract N00014-75-C-0585; AF Proj. 2421)

(AD-A080968; AFML-TR-79-4055) Avail: NTIS HC A03/MF A01 CSCL 11B

A combination of experimental techniques is used to characterize the viscoelastic properties of three lubricant candidates. These data were used as inputs in a model calculation to evaluate the traction characteristics of the candidate fluids for application to rolling element bearing analysis. All are found to have lower traction coefficients than the best traction fluids currently available. The major cause of this stems from the relatively slow variation of the shear viscosity with pressure in all three fluids and in one case a rather broad relaxation time spectrum. The other viscoelastic factors that are important in determining traction are found to be in a quite normal range. GRA

N80-23659# United Technologies Research Center, East Hartford, Conn.

EVALUATION OF BASIC LASER WELDING CAPABILITIES Final Report, 1 Jun. 1974 - 31 May 1979

D. B. Snow, M. J. Kaufman, C. M. Banas, and E. M. Breinan Jul. 1979 44 p refs

(Contract N00014-74-C-0423)

(AD-A077575; UTRC/R79-911989-17) Avail: NTIS HC A03/MF A01 CSCL 20/5

5456 and 5086 aluminum alloys were welded with a continuous, cross-beam CO2 laser operated in the master oscillator/power amplifier mode (Gaussian beam). Extensive experimental parameter modifications were made to the welding apparatus in an attempt to improve weld quality, in particular the reproducibility and uniformity of fusion zone penetration. The effects of laser (power, mode, optics), process (welding speed, beam rotation, shielding design) and other (weld prep, wire feed, flux, backup, etc.) parameters on weld performance were evaluated. Although some progress was demonstrated, the capability for generation of sound autogenous laser weldments in these alloys on a reproducible basis was not established within the scope of this program. Areas of endeavor which might be expected to produce further significant improvement in the ability to laser weld 5000 series aluminum alloys are not evident at this time. GRA

N80-23660# Northern Research and Engineering Corp., Cambridge, Mass. Applied Sciences Group.
ELECTRIC FUEL NOZZLES FOR COMBUSTORS
W. Jansen, I. P. Krepchin, M. J. Paradise, R. Cignoni, R. D. Grzybinski, E. P. Demetri, M. Platt, E. R. Norster, and W. H. Robinson 7 Mar. 1979 65 p refs
(Contract EY-76-C-03-1442)
(SAN/1442-79/T1) Avail: NTIS HC A04/MF A01

The feasibility of electrically charging the fuel droplets from a conventional atomizer by means of high-voltage electrodes was investigated. This method of fuel injection was proposed to improve the uniformity of the fuel/air distribution in the combustion zone and, at the same time, reduce power requirements by eliminating the need to introduce turbulent air flows and the accompaning large pressure drops. Two nozzle configurations, both utilizing the principle of corona discharge, were designed and fabricated. The initial tests were performed but the results did not warrant further testing. The fuel was not sufficiently charged to affect distribution. The conclusion was that droplets were moving too fast and their conductivity was too low for adequate charging to take place. Another effect observed, however holds the promise of eventually applicable to an electric nozzle. This is the phenomenon in which a thin film of jets shooting off the surface. DOE

N80-23661# Mechanical Technology, Inc., Latham, N. Y.
MAGNETIC BEARING SUPPORT STUDY FOR A 10 kW-hr ENERGY STORAGE FLYWHEEL
M. W. Eusepi and D. F. Wilcock Nov. 1979 180 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7025; MTI-75TR59) Avail: NTIS HC A09/MF A01

The design of a magnetic suspension system which fully supports a 10 kW-hr energy storage flywheel is presented. Discussions leading to the selection of the design to other storage levels ranging from a 1 kW-hr vehicular size to a large 100 kW-hr stationary system are included. DOE

N80-23662# General Electric Co., Schenectady, N. Y. Gas Turbine Div.
DEVELOPMENT OF HIGH-TEMPERATURE TURBINE SUBSYSTEM TECHNOLOGY TO A TECHNOLOGY READINESS STATUS, PHASE 2 Quarterly Report, Apr. - Jun. 1978
A. Caruvana, E. D. Alderson, N. R. Antrim, H. V. Doering, R. P. Dubois, M. Dreedman, and R. Frishmuth Jul. 1978 185 p refs
(Contract EX-76-C-01-1806)
(FE-1806-48) Avail: NTIS HC A09/MF A01

Progress is reported in a program design to bring to technology readiness, over a six- to ten year duration, a coal-derived fuel at a firing temperature of 2600 F with growth capability 3000 F. The objectives of phase 2 are to: perform component design and trade-off analyses in sufficient depth to support the component design and test tasks; and update the phase 1 combined cycle studies to evaluate the commercial viability of a GE-TRV turbine system. Information is included on hot gas path development test facilities, low BTU gas cleanup system, motorized rig test air turbine tests, liquid- and gas-fueled combined cycle power plants, turbine subsystem design, update of verification tests system definition and technology readiness vehicle design. DOE

N80-23663# Bundesministerium fuer Forschung und Technologie, Bonn (West Germany).
DEVELOPMENT OF A ROTARY HIGH PRESSURE DISPLACEMENT PUMP FOR REVERSED OSMOSIS SYSTEMS FOR SEAWATER DESALINATION Final Report
Gerhard Bardewyck (Bornemann (J. H.) Company) Dec. 1978 40 p In GERMAN; ENGLISH summary
(BMFT-FB-M-78-08) Avail: NTIS HC A03/MF A01; Fachinformationszentrum, Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 8,40

A rotary screw pump was developed for use in plants accomplishing sea water desalination through reverse osmosis. The pump operates at pressures of up to 100 bar, has better than average efficiency, and is free of pulsation. Studies were performed to optimize the rotor profiles of the pump.
Author (ESA)

N80-23664# Eidgenoessisches Flugzeugwerk, Emmen (Switzerland). Research and Testing Dept.
STUDY AND DETAIL DESIGN OF THE ENGINEERING MODEL OF A VAPOR COMPRESSOR TO BE USED IN SPACE Final Report
F. Berner, H. Oesch, and O. Joeri Dec. 1979 85 p refs
(Contract ESA-3770/78-NL-PP)
(F/W-FO-1498; ESA-CR(P)-1277) Avail: NTIS HC A05/MF A01

An engineering model of a vapor compressor was designed for a refrigeration unit to be used in Spacelab. The piston compressor which, when incorporated in an optimally controlled refrigeration unit using freon 12 as the working fluid, allowed cooling of a payload down to about -27 C at heat removal rates of about 70 W under conditions where the heat sink fluid enters the condenser with a temperature of 40 C. Alternately, the heat removal rate at the source was increased to about 3 W. The shaft power required by the compressor under these conditions was expected to be about 12 W. The compressor was designed to operate under normal atmospheric conditions along with its drive unit even if placed in a vacuum.
Author (ESA)

N80-23491 Shock and Vibration Information Center (Defense), Washington, D. C.
TECHNIQUES AND APPLICATIONS OF MECHANICAL SIGNATURE ANALYSIS
R. H. Volin *In its* The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 17-33 refs (For primary document see N80-23490 14-31)
Avail: NRL Code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-23498*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ORBITER DOOR CLOSURE TOOLS
William R. Acres *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 19-31 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23500*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FLUID CIRCULATING PUMP OPERATED BY SAME INCIDENT SOLAR ENERGY WHICH HEATS ENERGY COLLECTION FLUID
Earl R. Collins *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 47-56 refs (For primary document see N80-23495 14-31)
(Contract NAS7-100)
Avail: NTIS HC A15/MF A01 CSCL 13K

N80-23501*# Vought Corp., Dallas, Tex.
THE ECCENTUATOR: A NEW CONCEPT IN ACTUATION
Robert G. Musgrove *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 57-67 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23502*# Institute for Industrial Research and Standards, Dublin (Ireland).

THE ACTUATED LATCH PIN AND ITS DEVELOPMENT
Patrick J. Lawlor *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 69-78 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23503*# Teldix Luftfahrt-Ausruestungs G.m.b.H., Heidelberg (West Germany).
BALL BEARING VERSUS MAGNETIC BEARING REACTION AND MOMENTUM WHEELS AS MOMENTUM ACTUATORS
W. Auer *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 79-91 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23504*# Societe Nationale Industrielle Aerospatiale, Paris (France).
CENTRIFUGAL REGULATOR FOR CONTROL OF DEPLOYMENT RATES OF DEPLOYABLE ELEMENTS
J. C. Vermalle *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 93-99 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23505*# Science Research Council, Chilton (England).
MECHANISMS OF UK RADIOMETERS FLOWN ON NIMBUS 5 AND 6 WITH PARTICULAR REFERENCE TO BEARINGS, PIVOTS AND LUBRICATION
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 101-110 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23506*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TRIPLE-AXIS COMMON-PIVOT ARM WRIST DEVICE FOR MANIPULATIVE APPLICATIONS
Leendert Kersten and J. Dwight Johnston *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 111-124 ref Prepared in cooperation with Nebraska Univ.-Lincoln (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23508*# Rockwell International Corp., Seal Beach, Calif. Space Systems Group.
A PRECISION BEARING GIMBAL SYSTEM FOR THE TEAL RUBY PROGRAM
Charles H. Lowry *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 143-153 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23509*# General Dynamics/Convair, San Diego, Calif.
FUEL/HYDRAULIC TRANSFER VALVE IMPROVES RELIABILITY OF ATLAS SPACE LAUNCH VEHICLE
M. Ogman *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 155-161 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13K

N80-23510*# Hughes Aircraft Co., Culver City, Calif.
KU BAND DEPLOYED ASSEMBLY AND GIMBAL
T. E. Deal *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 163-172 Sponsored in part by Rockwell International Corp. (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23515*# Rockwell International Corp., Downey, Calif. Space Operations and Satellite Systems Div.
A MECHANICAL ADAPTER FOR INSTALLING MISSION EQUIPMENT ON LARGE SPACE STRUCTURES
A. LeFever and R. S. Totah *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 237-245 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23516*# Grumman Aerospace Corp., Bethpage, N.Y.
AUTOMATED BEAM BUILDER
Walter K. Muench *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 247-265 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23517*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
THE MAGSAT MAGNETOMETER BOOM
James F. Smola, Wade E. Radford, and Marcus H. Reitz *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 267-278 ref (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23518*# General Electric Co., Philadelphia, Pa. Reentry Systems Div.
DRAWER DRIVE FOR SPACE SHUTTLE VACUUM CANISTER
Kenneth E. Werner *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 279-288 (For primary document see N80-23495 14-31)
(Contract NAS1-14375)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23521*# Ford Aerospace and Communications Corp., Newport Beach, Calif.
THE DESIGN AND APPLICATION OF AN ANTENNA POSITIONER MECHANISM FOR INTELSAT-5 SERIES COMMUNICATION SATELLITE
Big Szeto *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 311-322 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

N80-23522*# Science Research Council, Chilton (England).
THE MECHANISMS OF THE SAMS EXPERIMENT FLOWN ON NIMBUS 7 WITH PARTICULAR REFERENCE TO THE 2 AXIS SCANNING MIRROR
H. Hadley *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 323-333 refs (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 13I

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N80-23665# Naval Research Lab., Washington, D. C.
NON-DESTRUCTIVE EVALUATION OF DEFECTS IN STRUCTURAL MATERIALS USING LONG-WAVELENGTH NEUTRONS
M. Fatemi and B. B. Rath Jan. 1980 22 p refs
(RR0220601)
(AD-A081097; NRL-TR-1) Avail: NTIS HC A02/MF A01 CSCL 14/2

Small-angle scattering profiles from HSLA steels (Fe-0.05C-1.0Mn-0.12Nb-0.06Al) annealed at various temperatures ranging between 660 C and 1000 C were obtained. The values obtained from Guinier analysis and size distribution calculations were compared with those obtained from electron micrographic observations, and were shown to agree satisfactorily. Similar data were obtained from samples of Ni-P amorphous glasses annealed at 295 C, 400 C, and 500 C. No crystallization effects were observed from 295 C sample. The Guinier plots of the 400 C and 500 C samples indicate good agreement with the expected behavior due to annealing of the amorphous state; namely, the higher annealing temperatures correspond to larger microcrystallite sizes. GRA

N80-23666# Mantech of New Jersey, Rockville, Md. Engineering Support Div.

DECISION PATH APPROACH TO GUIDANCE FOR CLIMATIC ENVIRONMENTAL TEST PLANNING (MIL-STD-810C) Technical Progress Report, 1 Oct. 1978 - May 1979
J. W. Hamilton and S. Cohen 12 Apr. 1979 133 p refs
(Contract DAAK70-78-C-0026)
(AD-A080909; ETL-0183) Avail: NTIS HC A07/MF A01 CSCL 14/2

The decision path method developed in this report provides a step-by-step logical approach to guidance for users of MIL-STD-810C. The method comprises systematic procedures for characterizing items of materiel and defining environments prior to designing tests. It is equally applicable as a general approach to all climatic environmental tests and as a specific approach to each climatic environmental test method in the Standard. Use of this approach should contribute to a better understanding of the MIL-STD's purpose, enhance its utility, and promote better correlation of test results. GRA

N80-23667# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
ULTRASONIC NONDESTRUCTIVE TESTING OF MATERIALS Annual Report, 1 Aug. 1978 - 31 Jul. 1979
Yih-Hsing Pao and Wolfgang Sachse Oct. 1979 31 p refs
(Contract F49620-78-C-0100; AF Proj. 2307)
(AD-A078370; AFOSR-79-1174TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

The method of phase spectroscopy was applied to measure dispersions of longitudinal and transverse waves in graphite-epoxy and boron-epoxy composite materials over a wide frequency range. A method to determine the attenuation from the dispersion based on the Kramers-Kronig relations was developed. To separate the attenuation due to scattering, and that due to viscosity, dispersion and attenuation of waves in a laminated viscoelastic composite material was analyzed using a statistical theory of multiple scattering. GRA

N80-23668# Los Alamos Scientific Lab., N. Mex.
THE LASL NONDESTRUCTIVE TESTING GROUP Interim Report
R. A. Morris and Larry Bryant 1979 8 p Presented at the WANTO Proc., Oak Ridge, Tenn., 9-11 Oct. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3071; CONF-791098-1) Avail: NTIS HC A02/MF A01

Topics discussed include: high-pressure diamond cell work; X-ray fluorescence analysis; shroud of Turin; laser fusion target inspection; and scanning electron microscope. Organization charts for the M-1 group are included. DOE

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N80-23669 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 11
Judith Nagle-Eshleman, ed. Nov. 1979 93 p refs
(AD-A078375) Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Substructuring methods for analysis of vibrating systems and computer program literature concerning shock and vibration isolation are presented. An abstract bibliography of current literature is given. For individual titles, see N80-23670 through N80-23671.

N80-23670 Tufts Univ., Medford, Mass. Dept. of Mechanical Engineering.
A REVIEW OF SUBSTRUCTURE ANALYSIS OF VIBRATING SYSTEMS
F. C. Nelson *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 11 Nov. 1979 p 3-9 refs
(For primary document see N80-23669 14-39)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual Rate $100.00

A general review of substructuring is presented, with emphasis placed on the method of component mode synthesis. Static substructuring is described as are dynamic substructuring by component mode synthesis and substructure truncation. Other substructuring methods are summarized. E.D.K.

N80-23671 Barry Controls, Inc., Watertown, Mass.
COMPUTER PROGRAMS: SHOCK AND VIBRATION ISOLATION
T. F. Derby *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 11 Nov. 1979 p 23-28 refs (For primary document see N80-23669 14-39)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Literature pertaining to computer programs useful in the analysis of shock and vibration isolation is reviewed. Topics included are the design of isolators, determination of required or optimum isolator parameters, and computational techniques. E.D.K.

N80-23672 Stanford Univ., Calif.
ELASTIC-PLASTIC DEFORMATION AT FINITE STRAIN Ph.D. Thesis
Vlado A. Lubarda 1980 45 p
Avail: Univ. Microfilms Order No. 8011672

Almost all current elastic-plastic theory is based on the total strain-rate being expressed as the sum of elastic and plastic strain-rates. This assumption and the kinematic model on which it is based are invalid and lead to erroneous conclusions. By defining plastic deformation as the residual deformation after unloading to zero macroscopic stress, the careful separation of elastic and plastic strain-rates is correctly achieved. On this basis the rate (incremental) type constitutive law for time independent material is rigorouly established. The law is not restricted to infinitesimal elastic strains, and Prandtl-Reuss equations follow as a special case of this general theory. The established constitutive law is then incorporated into the structure of the finite deformation variational principle by deriving the expression for the rate potential function. This is oriented toward the direct use in the finite element evaluation of boundary-value problems. The presentation and the development of the whole theory is given at the level of modern continuum mechanics. Dissert. Abstr.

N80-23673 Minnesota Univ., Minneapolis.
STUDIES IN THE SMALL MOTIONS OF VISCOELASTIC SOLIDS Ph.D. Thesis
Prakash Mahadeo Dixit 1979 187 p
Avail: Univ. Microfilms Order No. 8011794

The reduced canonical forms of the stress and equations of motion governing the motions which perturb the natural state of viscoelastic solids are derived. For simplicity only homogeneous, isotropic, incompressible solids are considered. The questions of uniqueness and stability are considered. It is shown that if the elastic constant and the viscoelastic function associated with the operator satisfy certain mild and physically natural conditions, then the limiting form of the solution as t approaches infinity is unique. This is equivalent to saying that under the above conditions the natural state of an incompressible solid is stable in linear approximation. Uniqueness of solutions of the initial-history-boundary-value problem is also considered. Also two free surface problems are considered. These problems involve computing the distortion of cylindrical or plane surfaces of solids in the natural state. In the problem of the sheared block the distortion occurs at first order while in the torsion of a viscoelastic cylinder arises at second order. In both the problems the motion is governed by fourth order partial differential equations. Dissert. Abstr.

N80-23674# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
MATHEMATICAL MODEL FOR THE SEPARATION OF GUST AND MANOEUVRE LOADS OF CIVIL AIRCRAFT
J. Taylor 1979 28 p refs
(FB-141(1979); ICAF-1135) Avail: NTIS HC A03/MF A01

Ignoring the unsteady lift functions, the normal acceleration response of an aircraft at its centre of gravity to a simplified

turbulence spectrum varying as frequency to the power -5/3 were studying. It is shown that the pitching influence usually reduces the response at long wavelengths from that produced by heaving alone. This influence was relatively small in piston-engined aircraft but has generally become greater as aircraft have developed. The increased response at long wavelengths in modern aircraft makes the problem of separating maneuvres from gust response more difficult but it is attenuated somewhat by the pitching contributions to the response. Experimental studies on a T33, on a Concorde and on a Transall indicate that a band frequency exists where the manoeuvres and turbulence responses are both small so that a filter within this band should separate one type of response from the other. Author

N80-23675# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SHEAR LIPS ON FATIGUE FRACTURES IN ALUMINUM ALLOY SHEET MATERIAL
J. Schijve Sep. 1979 26 p refs
(LR-287; ICAF-1112) Avail: NTIS HC A03/MF A01

Shear lip width measurements and the transition of tensile mode fatigue cracks to shear mode fatigue cracks, as observed on fatigue crack surfaces of aluminum alloy sheet material are analyzed. It is shown that these phenomena were controlled by delta K sub eff rather than K sub max or delta K. For crack growth in air the shear lip width was approximately proportional to the square of delta K sub eff, but is was significantly larger than the estimated size of the reversed plastic zone. The initiation of shear lips, the transition from plane stress to plane strain along the crack front, and the environmental effect on shear lips are briefly considered in the discussion. M.G.

N80-23676# Laboratorium fuer Betriebsfestigkeit, Darmstadt (West Germany).
THE SIGNIFICANCE OF THE FATIGUE STRENGTH IN THE POWDER METALLURGY
Catin Morris Sonsino and Gottfried Hoffman 1979 7 p refs Repr. from Arch. Eisenhuettenw. (West Germany), v. 50, no. 12, 1979 p 533-538 In GERMAN; ENGLISH summary
(ICAF-1134) Avail: NTIS HC A02/MF A01

The importance of fracture mechanical parameters, cyclic stress-strain curve, S/N curve, fatigue life curve, scatter, probability of survival and failure and significance analysis in powder metallurgy is discussed as well as the possible influences of homogenizing and pore shape on fracture mechanical parameters, of porosity on the cyclic stress-strain behavior, on the fatigue strength and on notch sensitivity. Differences between S/N and fatigue life curves are discussed. A.R.H.

N80-23677*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
ELASTIC CONSTANTS FOR SUPERPLASTICALLY FORMED/DIFFUSION-BONDED CORRUGATED SANDWICH CORE
William L. Ko May 1980 82 p refs
(NASA-TP-1562; H-1094) Avail: NTIS HC A05/MF A01 CSCL 20K

Formulas and associated graphs for evaluating the effective elastic constants for a superplastically formed/diffusion bonded (SPF/DB) corrugated sandwich core, are presented. A comparison of structural stiffnesses of the sandwich core and a honeycomb core under conditions of equal sandwich core density was made. The stiffness in the thickness direction of the optimum SPF/DB corrugated core (that is, triangular truss core) is lower than that of the honeycomb core, and that the former has higher transverse shear stiffness than the latter. E.D.K.

N80-23678*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
STATUS OF NASA FULL-SCALE ENGINE AEROELASTICITY RESEARCH
Joseph F. Lubomski 1980 21 p refs Presented at the 21st Struct., Structural Dyn., and Mater. Conf., Seattle, 12-14 May 1980; sponsored by AIAA, ASME, ASCE and AHS
(NASA-TM-81500; E-437) Avail: NTIS HC A02/MF A01 CSCL 20K

Data relevant to several types of aeroelastic instabilities were obtained using several types of turbojet and turbofan engines. In particular, data relative to separated flow (stall) flutter, choke flutter, and system mode instabilities are presented. The unique characteristics of these instabilities are discussed, and a number of correlations are presented that help identify the nature of the phenomena. R.E.S.

N80-23679*# California Inst. of Tech., Pasadena.
VISUALIZATION OF IMPACT DAMAGE OF COMPOSITE PLATES BY MEANS OF THE MOIRE TECHNIQUE
W. G. Knauss, C. D. Babcock, and H. Chai Apr. 1980 53 p refs
(Grant NsG-1483)
(NASA-CR-159261; SM-79-9) Avail: NTIS HC A04/MF A01 CSCL 11D

The phenomenological aspects of propagation damage due to low velocity impact on heavily loaded graphite-epoxy composite laminates were investigated using high speed photography coupled with the moire fringe technique. High speed moire motion records of the impacted specimens are presented. The results provide information on the time scale and sequence of the failure process. While the generation of the initial damage cannot always be separated temporally from the spreading of the damage, the latter takes place on the average with a speed on the order of 200 m/sec. R.E.S.

N80-23680*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
USER'S MANUAL TO THE ACTION COMPUTER CODE
Monohar P. Kamat Apr. 1980 78 p
(Contract NAS1-15080)
(NASA-CR-144973) Avail: NTIS HC A05/MF A01 CSCL 20K

The form and interpretation of input and output data are defined. The Analysis of Crash Transients in Inelastic and Geometrically Nonlinear structures program (ACTION) performs nonlinear transient response analysis of structures subjected to time varying loads, allowing for nonlinear, time independent material properties and large geometry changes. Author

N80-23681# Chi Associates, Inc., Arlington, Va.
STATE-OF-THE-ART REPORT ON NUMERICAL INTEGRATION METHODS FOR ANALYSIS OF STIFF STRUCTURAL ANALYSIS SYSTEMS
John Tucker and Michael Chi [1980] 60 p refs
(Contract DOT-HS-7-10620)
Avail: NTIS HC A04/MF A01

The state-of-the-art of integration methods suitable for stiff, nonlinear systems were assessed to improve the computational efficiency of vehicle structural dynamics simulation programs. Applicable methodologies were analyzed and their strengths and weaknesses cited. Criteria were developed for their applicability to stiff, nonlinear systems. R.E.S.

N80-23682*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ROOM TEMPERATURE MECHANICAL PROPERTIES OF SHUTTLE THERMAL PROTECTION SYSTEM MATERIALS
James Wayne Sawyer and Donald R. Rummler Apr. 1980 39 p ref
(NASA-TM-81786) Avail: NTIS HC A03/MF A01 CSCL 20K

Tests were conducted at room temperature to determine the mechanical properties and behavior of materials used for the thermal protection system of the space shuttle. The materials investigated include the LI-900 RSI tiles, the RTV-560 adhesive and the .41 cm (.16 thick) strain isolator pad (SIP). Tensile and compression cyclic loading tests were conducted on the SIP material and stress-strain curves obtained for various proof loads and load cyclic conditioning. Ultimate tensile and shear tests were conducted on the RSI, RTV, and SIP materials. The SIP material exhibits highly nonlinear stress-strain behavior, increased tangent modulus and ultimate tensile strength with increased loading rate, and large short time load relaxation and moderate creep behavior. Proof and cyclic load conditioning of the SIP results in permanent deformation of the material, hysteresis effects, and much higher tensile tangent modulus values at large strains. R.E.S.

N80-23683*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MINIMUM MASS SIZING OF A LARGE LOW-ASPECT RATIO AIRFRAME FOR FLUTTER-FREE PERFORMANCE
William H. Greene and Jaroslaw Sobieszczanski-Sobieski May 1980 40 p refs Presented at the 21st Struct., Structural Dyn., and Mater. Conf., Seattle, 12-14 May 1980; sponsored by AIAA, ASME, ASCE and AHS
(NASA-TM-81818; AIAA-80-0724CP) Avail: NTIS HC A03/MF A01 CSCL 20K

A procedure for sizing an airframe for flutter-free performance is demonstrated on a large, flexible supersonic transport aircraft. The procedure is based on using a two level reduced basis or modal technique for reducing the computational cost of performing the repetitive flutter analyses. The supersonic transport aircraft exhibits complex dynamic behavior, has a well-known flutter problem and requires a large finite element model to predict the vibratory and flutter response. Flutter-free designs were produced with small mass increases relative to the wing structural weight and aircraft payload. R.E.S.

N80-23684*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRACTICAL IMPLEMENTATION OF THE DOUBLE LINEAR DAMAGE RULE AND DAMAGE CURVE APPROACH FOR TREATING CUMULATIVE FATIGUE DAMAGE
S. S. Manson (Case Western Reserve Univ.) and G. R. Halford Apr. 1980 50 p refs
(NASA-TM-81517; E-387) Avail: NTIS HC A03/MF A01 CSCL 20K

Simple procedures are presented for treating cumulative fatigue damage under complex loading history using either the damage curve concept or the double linear damage rule. A single equation is provided for use with the damage curve approach; each loading event providing a fraction of damage until failure is presumed to occur when the damage sum becomes unity. For the double linear damage rule, analytical expressions are provided for determining the two phases of life. The procedure involves two steps, each similar to the conventional application of the commonly used linear damage rule. When the sum of cycle ratios based on phase 1 lives reaches unity, phase 1 is presumed complete, and further loadings are summed as cycle ratios on phase 2 lives. When the phase 2 sum reaches unity, failure is presumed to occur. No other physical properties or material constants than those normally used in a conventional linear damage rule analysis are required for application of either of the two cumulative damage methods described. Illustrations and comparisons of both methods are discussed. Author

N80-23685*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
COMPARISON OF STRUCTURAL BEHAVIOR OF SUPER-PLASTICALLY FORMED/DIFFUSION-BONDED SANDWICH STRUCTURES AND HONEYCOMB CORE SANDWICH STRUCTURES
William L. Ko Jun. 1980 35 p refs
(NASA-TM-81348) Avail: NTIS HC A03/MF A01 CSCL 20K

A superplasticity formed/diffusion-bonded (SPF/DB) orthogonally corrugated core sandwich structure is discussed and its structural behavior is compared to that of a conventional honeycomb core sandwich structure. The stiffness and buckling characteristics of the two types of sandwich structures are compared under conditions of equal structural density. It is shown that under certain conditions, the SPF/DB orthogonally corrugated core sandwich structure is slightly more efficient than the optimum honeycomb core (square-cell core) sandwich structure. However, under different conditions, this effect can be reversed. R.C.T.

N80-23686# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
APPLICATIONS OF GENERALIZED DERIVATIVES TO VISCOELASTICITY
Ronald L. Bagley Nov. 1979 119 p refs
(AF Proj. 2418)
(AD-A081131; AFML-TR-79-4103) Avail: NTIS HC A06/MF A01 CSCL 20/11

Generalized derivatives of fractional order are used to construct stress-strain constitutive relations for viscoelastic materials, based on the observed sinusoidal behavior of the materials. The non-periodic behavior of one material is observed in the laboratory and compares favorably with the non-periodic behavior of the material predicted by its generalized derivative constitutive relation. Having established that the generalized derivative constitutive relation is an appropriate mathematical model for the general motion of at least one viscoelastic material, the tools for the analysis of structures of engineering interest are put forward. In particular, attention is focused on a finite element formulation of and solutions to the equations of motion for structures containing elastic and viscoelastic components. GRA

N80-23687# Naval Ocean Systems Center, San Diego, Calif.
DYNAMICS OF A MOVING MASS BEING ABRUPTLY STOPPED BY A CABLE Final Report
R. W. Buecher Dec. 1979 13 p
(R011B0S)
(AD-A081158; NOSC/TR-489) Avail: NTIS HC A02/MF A01 CSCL 20/11

The one dimensional wave equation is used to determine the propagation of tension in a cable that abruptly stops a moving mass. A simple simulation is used to determine tension propagation when the end of the cable opposite the moving mass is fixed and tension reflections occur. Predicted tensions compare favorably with those determined by experiment. GRA

N80-23688# Northwestern Univ., Evanston, Ill. Technological Inst.
CRITICAL DAMPING IN LINEAR DISCRETE DYNAMIC SYSTEMS
D. E. Beskos and B. A. Boley Nov. 1979 23 p refs Prepared in cooperation with Minnesota Univ., Minneapolis
(Contract N00014-75-C-1042)
(AD-A081085; TR-1979-2) Avail: NTIS HC A02/MF A01 CSCL 20/11

Free viscously damped vibrations of linear discrete structural systems are studied. The amount of damping varies among the various structural elements of the system resulting in several critical damping possibilities. A general method is developed for determining the critical damping surfaces of a system. These surfaces represent the loci of combinations of damping values corresponding to critically damped motions, and thus separate regions of partial or complete underdamping for those of overdamping. The dimension of a critical damping surface is equal to the number of independent amounts of damping present in the system. The determination of the surface point corresponding to equal amounts of damping is considerably simplified for systems which, on the assumption that all amounts of damping are equal, possess a damping matrix of the Rayleigh type. Three examples presented in detail illustrate the proposed technique and some of the important characteristics of critical damping surfaces. GRA

N80-23689# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
SOME COMMENTS ON THE ENDOCHRONIC THEORY OF PLASTICITY
R. S. Rivlin Oct. 1979 47 p refs
(Contract N00014-76-C-0235)
(AD-A081825; CAM-100-33) Avail: NTIS HC A03/MF A01 CSCL 20/13

Two endochronic theories of plasticity advanced by Valanis in 1971 and 1978 are discussed critically. It is concluded that the first of these theories, which does not involve a yield surface or a separation of strain into plastic and elastic components, cannot form an appropriate basis for the mechanics of metals. The second theory is a more conventional theory involving a yield surface with kinematic and isotropic hardening. However, there is no evidence that the particular laws employed by Valanis accord with experiment. GRA

N80-23690# Lockheed Missiles and Space Co., Palo Alto, Calif.
COMPUTER ANALYSIS OF SHELLS AND COMPOSITES Final Report, Oct. 1977 - Dec. 1979
David Bushnell and Frank W. Crossman Dec. 1979 28 p
(Contract F49620-77-C-0122; AF Proj. 2307)

(AD-A081469; LMSC-D684018; AFOSR-80-0136TR) Avail: NTIS HC A03/MF A01 CSCL 11/4

Task 1 hygrothermal, viscoelastic plane stress and generalized plane strain analysis codes were developed and employed to determine the influence of hygrothermal history on laminate inplane and free edge stresses and dimensional stability. Task 2 monographs were written on plastic buckling, stability and optimization of panels, and buckling of shells. The surveys include many examples of nonlinear collapse and bifurcation buckling in which moderately large deflections, nonlinear material effects, and imperfections are accounted for. Their purpose is to give the reader a physical feel for thin shell behavior that will help him to design appropriate tests and perform efficient numerical analyses with existing computer programs for the treatment of structures composed of thin sections. GRA

N80-23691# Lehigh Univ., Bethlehem, Pa. Center for Application of Mathematics.

INTERACTION OF LARGE AMPLITUDE STRESS WAVES IN LAYERED ELASTIC-PLASTIC MATERIALS Final Report, Aug. 1976 - Sep. 1979

Eric Varley Feb. 1980 12 p refs

(Grant DAAG29-76-G-0319)

(AD-A081429; ARO-14110.2-E) Avail: NTIS HC A02/MF A01 CSCL 11/9

Mathematical techniques are developed to analyze the nonlinear wave interactions that occur when a uni-directional wave traveling through an hysteretic material arrives at an interface with some other hysteretic material. Also, mathematical techniques are developed to describe the deformations of finitely strained materials surrounding cracks, notches, and inclusions. GRA

N80-23692# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Structures Lab.

TENSILE CRACK EXPOSURE TESTS. REPORT 3: LABORATORY EVALUATION OF SERIES A BEAMS WITH RESULTS FROM 1951 TO 1975

Edward F. ONeil Jan. 1980 73 p refs

(AD-A081302; WES-TM-6-412-3; Rept-3) Avail: NTIS HC A04/MF A01 CSCL 13/13

A study was begun in 1950 to determine the effects of severe natural weathering to stressed, reinforced concrete beams of various compositions and degrees of stress. The objectives of the study were to obtain information on the long-term weathering of air-entrained and nonair-entrained concrete beams containing steels of different compositions, types of deformation, and having different levels of stress in the steel that caused varying degrees of cracking of the concrete. The beams were fabricated, cured, and loaded at the U.S. Army Engineer Waterways Experiment Station (WES) in 1951, then shipped to Eastport, Maine, and placed on the beach at the natural weathering exposure station on the south side of Treat Island, Cobscock Bay, Eastport, and Lubec. The beams were subjected to twice daily tidal cycles exposing them to wetting under considerable head, and drying to surface dry conditions. The beams were inspected annually during the exposure period and evaluated by a team of inspectors rating the degree of deterioration. Each year, maximum crack widths were measured beginning in 1956 and continuing until 1975 when the exposure period was concluded after 25 years of weathering. The results of the exposure study and the laboratory investigation indicated, among other findings, that stressing the steel to varying levels of stress over the exposure period did not reduce the ultimate moment carrying capacity of the beams; the maximum areas of corrosion occurred at spalled areas; corrosion to the steel could not be located at any flexural crack smaller than 0.015 in. (0.38 mm); and no area of maximum reduction of cross-sectional are due to corrosion occurred at the flexural cracks. GRA

N80-23693# Naval Postgraduate School, Monterey, Calif.

AN INVESTIGATION OF RESIDUAL STRESSES IN SIMULATED WING PANELS OF 7075-T6 ALUMINUM M.S. Thesis

Edward C. Engle Dec. 1979 46 p refs

(AD-A080863) Avail: NTIS HC A03/MF A01 CSCL 11/6

The advent of onboard aircraft microprocessor fatigue monitoring systems will establish the opportunity to fully exploit residual stresses at stress-critical areas, including their effects on fatigue predictions. An experimental investigation was undertaken to more fully understand them by making photoelastic measurements of residual stresses at notches in simulated wing panels of 7075-T6 aluminum and to establish the relationships between local stresses, residual stresses, and the far-field or applied stress. The stress concentration factors were found to decrease with increased plastic deformation while the strain concentration factors were found to remain constant. The residual stress levels were found to be immutable despite changes in fatigue loading conditions, notch geometry, or test duration.GRA

N80-23694# Oakland Univ., Rochester, Mich. School of Engineering.

LIGHTER AND STRONGER

A. J. Durelli and K. Rajaiah Feb. 1980 54 p refs

(Contract N00014-76-C-0487; Grant NSF ENG-77-07974)

(AD-A081317; Rept-53) Avail: NTIS HC A04/MF A01 CSCL 20/11

A new method has been developed that permits the direct design of shapes of two dimensional structures ad structural components, loaded in their plane, within specified design constraints and exhibiting optimum distribution of stresses. The method uses photoelasticity and requires a large field diffused light polariscope. Several problems of optimization related to the presence of holes in finite and infinite plates, subjected to uniaxial and biaxial loadings, are solved parametrically. Some unexpected results have been found: (1) the optimum shape of a large hole in a bar of finite width, subjected to uniaxial load, is 'quasi' square, but the transverse boundary has the configuration of a 'hat'; (2) for the small hole in the large plate, a 'barrel' shape has a lower s.c.f. than the circular hole and appreciably higher coefficient of efficiency; and (3) the optimum shape of a tube, subjected to diametral compression, has small 'hinges' and is much lighter and stronger than the circular tube. Applications are also shown to the design of dove-tails and slots in turbine blades and rotors, and to the design of star-shaped solid propellant grains for rockets. GRA

N80-23695# Brown Univ., Providence, R. I. Center for Dynamical Systems.

THE EQUATIONS OF ELASTICITY ARE SPECIAL

C. M. Dafermos Oct. 1979 15 p refs

(Contract N00014-76-C-0278; Grants DAAG29-76-G-0294; NSF MCS-79-05774)

(AD-A081668) Avail: NTIS HC A02/MF A01 CSCL 20/1

In dynamics, the goal is to relate the Second Law of thermodynamics with 'stability'. The work of Ericksen reveals that the Second Law induces stability of an equilibrium state of a thermoelastic material in the range of convexity of internal energy (e.g., at points where energy attains a minimum.) Similarly, it has been shown that smooth adiabatic processes in thermoelasticity, residing in the range of convexity of internal energy, depend continuously upon the initial state, even within the class of processes that develop shock waves. Actually, in certain circumstances, the same result can be established under a mere strong ellipticity assumption. GRA

N80-23696# California Univ., Berkeley. Dept. of Mechanical Engineering.

ANALYTICAL STRESS ANALYSIS OF ELASTIC COMPOSITES WITH CRACKS Final Report

D. B. Bogy Aug. 1979 74 p refs

(Contract W-7405-eng-48)

(UCRL-15109) Avail: NTIS HC A04/MF A01

The elastostatic axisymmetric problem of a sphere, containing a centrally located penny-shaped crack, embedded in a dissimilar matrix subject to far field loads is solved. First the problem of a cracked sphere is solved by using Boussinesq stress-functions. Two coordinate systems - oblate spheroidal for representing the crack surface and spherical polars for the spherical surface - are used to satisfy boundary conditions. Integral representations and transformations of harmonic functions are used to relate stress-functions in the two coordinate systems. This procedure leads to a system of algebraic equations which are solved, for axisymmetric tractions on both the surfaces. This solution is then used to obtain the solution of the original problem. A representation of the solution for the axisymmetric problem of a crack in an infinite medium is also presented. DOE

N80-23697# Oak Ridge National Lab., Tenn.
BEHAVIOR OF DEEP FLAWS IN A THICK-WALL CYLINDER UNDER THERMAL SHOCK LOADING
R. D. Cheverton 1979 24 p refs Presented at the Water Reactor Safety Meeting, Washington, D.C., 5 Nov. 1979
(Contract W-7405-eng-26)
(CONF-791123-3) Avail: NTIS HC A02/MF A01

Behavior of inner-surface flaws in thick-walled vessels was studied in a 991-mm OD x 152 mm wall x 1220 mm length cylinder with toughness properties similar to those for HSST Plate. The initial temperature of 93 C and a thermal shock medium of liquid nitrogen (.197 C) were employed. The initial flaw selected was a sharp, 16 mm deep, long (1220 mm) axial crack. Crack arrest methodology was shown to be valid for deep flaws under severe thermal shock. DOE

N80-23698# Sandia Labs., Livermore, Calif. Data Processing Div.
TECHNICAL MANUAL: PRIMARY DATA REDUCTION PROGRAMS FOR THE ECLIPSE S-200/230 SHOCK AND VIBRATION MEASUREMENT SYSTEMS
H. W. Swan Nov. 1979 41 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8054) Avail: NTIS HC A03/MF A01

The internal workings and computational algorithms for the quick-look plotting programs and primary data reduction programs for the Eclipse computer-based shock and vibration test centers are described. DOE

N80-23699# Hanford Engineering Development Lab., Richland, Wash.
EVALUATION OF THE ROUND COMPACT SPECIMEN FOR FATIGUE-CRACK GROWTH RATE TESTING
L. A. James and W. J. Mills Apr. 1979 18 p refs Presented at the ASTM Symp. on Fatigue Crack Growth Meas. and Data Anal., Pittsburgh, 29 Oct. - 2 Nov. 1979
(Contract EY-76-C-14-2170)
(HEDL-SA-1810; CONF-7910102-2) Avail: NTIS HC A02/MF A01

A proposed round compact specimen was evaluated for its suitability for fatigue crack growth rate testing. The results were compared to results from standard compact specimens, and the two sepcimens were found to yield equivalent results. A number of K solutions were proposed for the round compact specimens, and these are reviewed. The agreement between the various solutions was good, and the Newman Equation was used to evaluate the present results. DOE

N80-23700# General Atomic Co., San Diego, Calif.
THERMAL STRESS ANALYSIS AND THE EFFECT OF TEMPERATURE DEPENDENCE OF MATERIAL PROPERTIES ON DOUBLET 3 LIMITER DESIGN
T. E. McKelvey, A. E. Koniges, F. Marcus, M. Sabado, and R. Smith Oct. 1979 8 p refs Presented at the 8th Symp. on Eng. Probl. of Fusion Res., San Francisco, 13 Nov. 1979
(Contract DE-AT03-76ET-51011)
(GA-A-15626; CONF-791102-48) Avail: NTIS HC A02/MF A01

Temperature and thermal stress parametric design curves are presented for two materials selected for Doublet 3 primary limiter applications. INC X-750 is a candidate for the medium Z limiter design and ATJ graphite for the low Z design. The dependence of significant material properties on temperature is shown and the impact of this behavior on the decision to actively or passively cool the limiter is discussed. DOE

N80-23701# General Atomic Co., San Diego, Calif.
BOUNDARY VALUE PROBLEMS OF THE CIRCULAR CYLINDERS IN THE STRAIN-GRADIENT THEORY OF LINEAR ELASTICITY
B. G. Kao Nov. 1979 43 p refs
(Contract DE-AT03-76ET-35300)
(GA-A-15142) Avail: NTIS HC A03/MF A01

Three boundary value problems in the strain-gradient theory of linear elasticity are solved for circular cylinders: the twisting of circular cylinders, uniformly pressuring of concentric circular cylinders, and pure-bending of simply connected cylinders. The comparisons of these solutions with the solutions in classical elasticity and in couple-stress theory reveal the differences in the stress fields as well as the apparent stress fields due to the influences of the strain-gradient. These aspects of the strain-gradient theory could be important in modeling the failure behavior of structural materials. DOE

N80-23702# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
IMPLICIT STRAIN-HARDENING FORMULATION FOR CREEP ANALYSIS
B. R. Bass, W. G. Johnson, and S. V. McGrath May 1979 29 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-30) Avail: NTIS HC A03/MF A01

A variable stiffness method for creep analysis is presented which utilizes a strain hardening theory of creep and an implicit time marching scheme. The formulation uses the change in stress and accumulated creep strain during a time interval to determine the corresponding creep strain increment. The method is suited for use in formulations of elastic plastic creep and large displacement, small strain analysis. Applications presented demonstrate that this implicit method offers numerical stability using relatively large time steps for which the conventional explicit scheme fails to function. DOE

N80-23703# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
THE INDENTATION OF AN ELASTIC LAYER BY A RIGID STAMP UNDER CONDITIONS OF COMPLETE ADHESION
J. P. Pauwelussen and J. B. Alblas (Technische Univ., Eindhoven, Netherlands) Aug. 1978 25 p refs Submitted for publication
(MC-TW-181/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The indentation of an elastic layer by a rigid stamp is treated under conditions of complete adhesion beneath the stamp, where the ratio of the half-width of the contact region and the thickness of the layer is assumed to be small. The cases of a flat stamp and a polynomial shaped one are considered successively and two applications are treated. Author (ESA)

N80-23704# Laboratoire Central des Ponts et Chaussees, Paris (France). Dept. des Betons et Metaux.
FATIGUE IN WELDED METAL STRUCTURES: AN INTRODUCTORY REPORT TO A RESEARCH PROGRAM
Pierre Brevet, Dominique Francois, Jean-Paul Gourmelon, and Andre Raharinaivo Nov. 1978 64 p refs In FRENCH; ENGLISH summary
(LPC-85) Avail: NTIS HC A04/MF A01

The problem of fatigue in welded metal structures is discussed using a review of the mathematical and physical theories of damage. The notions of lifetime and endurance of the parts subjected to fatigue are examined and the characteristic Woehler's and Goodman-Smith's diagrams are presented. The points in a metal structure carrying traffic which are most liable to the risks of fatigue damage are indicated. The influence of the characteristics of welded joints on the behavior of assemblies under fatigue is examined. The characteristics are either of a geometric nature, including porosity, blisters, and defects such as lack of fusion, or of a metallurgical origin. Ways of improving the behavior of welded joints under fatigue are indicated. Author (ESA)

N80-23705# European Space Agency, Paris (France).
CHANCES AND HANDICAPS OF ROD-BEAM THEORIES
Dieter Peterson Nov. 1979 39 p refs Transl. into ENGLISH of "Moeglichkeiten und. Grenzen der Stabtheorien". Rept. DFVLR-FB-78-13 DFVLR, Brunswick, Jul. 1978 Original report in GERMAN previously announced as N79-30583
(ESA-TT-568; DFVLR-FB-78-13) Avail: NTIS HC A03/MF A01; ZLDI, Munich DM 17.50

The assumptions inherent in the hypotheses of rod-beam theories, such as the one of Bernoulli suggesting even cross-sections under deformation, limit the accuracy of analysis. It is shown that for higher order terms geometrically nonlinear deformations are in contradiction with rod-beam hypotheses. The consistent use of differential calculus uncovers simultaneously geometric differences between current rod-beam theories of higher order. These differences are examined using simple examples. Author (ESA)

N80-23706# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Numerical Analysis and Computing Science.
INTERACTIVE SIMULATION OF THE PROGRESSIVE COLLAPSE OF A BUILDING REVISITED
Per Loetstadt 1979 31 p refs Sponsored by Swedish Inst. of Applied Mathematics
(TRITA-NA-7921) Avail: NTIS HC A03/MF A01

A computer program is described which simulates the large scale behavior of a collapsing building. A two dimensional model is developed, where the walls and floors are regarded as rigid bodies. The numerical algorithm for solving the contact forces, accelerations, velocities and positions is discussed and its deficiencies are pointed out. A literature survey of the simulation of rigid body mechanical systems is included. Author (ESA)

N80-23707# Bristol Univ. (England). Dept. of Aeronautical Engineering.
THE EFFECT OF FOAMED HARD PLASTIC STIFFENERS ON ALUMINUM SHEAR WEBS B.S. Thesis
A. Breeze-Stringfellow and A. C. Duthie Jun. 1979 52 p refs
(BU-237) Avail: NTIS HC A04/MF A01

The effect of foamed hard plastic stiffeners on aluminum shear webs was investigated. Shear webs of varying gauges were tested with varying depths of stiffener, the stiffener width and spacing being kept constant. The foam used was Rohacell 31 and the aluminum was L72. The addition of foam stiffeners increased the workable stress and shear stiffness of the shear web. Above a certain depth of stiffener, no further increase of workable stress and web stiffness was found; it was this depth that was taken as the optimum value. Author (ESA)

N80-23708# Oxford Univ. (England). Dept. of Engineering Science.
PEAK WIND LOADS ON CLADDING PANELS AND THEIR DEPENDENCE UPON PANEL SIZE
M. E. Greenway 1979 45 p refs
(OUEL-1286/79) Avail: NTIS HC A03/MF A01

Peak wind induced loads on cladding panels fixed to the windward face of a building are considered. A total of two gust factor equations are derived which describe the ratio of the peak load on a cladding panel to the mean load. The equations do not apply if the panel is in a region of separated flow. The first equation is based on a linearized theory for the pressure developed on the windward face of a tall building; the second is a nonlinear form of the same equation. The equations are used to calculate peak loads on cladding panels positioned at various heights on a tall building. An explanation is offered for the observed relatively frequent failure of cladding panels at low levels on some tall buildings. Author (ESA)

N80-23709# Oxford Univ. (England). Dept. of Engineering Science.
AN ANALYSIS OF THE STATIC AND DYNAMIC INSTABILITY OF THICK CYLINDERS
John D. Renton 1979 20 p refs
(OUEL-1292/79) Avail: NTIS HC A02/MF A01

A general solution of Bolotin's differential equations for the dynamic stability of a homogenous isotropic medium is given. This takes the form of displacement functions, which express the solution as a sum of dilatational and distortional effects. Solutions are found for the vibration of cylinders of finite thickness when initial axial stresses are present. It is shown that simple vibration and simple buckling are cases of the general solution. The results are compared with approximate formulas for the buckling of thin cylinders and it is shown that the known solution for the natural frequency of unloaded cylinders is a particular case. Author (ESA)

N80-23492 Imperial Coll. of Science and Technology, London (England). Dept. of Mechanical Engineering.
DAMPING IN STRUCTURAL JOINTS
C. F. Beards *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 9 Sep. 1979 p 35-41 refs (For primary document see N80-23490 14-31)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-24252 Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
RECENT RESEARCH IN COMPOSITE AND SANDWICH PLATE DYNAMICS
C. W. Bert *In* Shock and Vibration Inform. Center. The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 13-23 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-24253 State Univ. of New York at Buffalo. Dept. of Mechanical Engineering.
OPTIMIZATION TECHNIQUES FOR SHOCK AND VIBRATION ISOLATOR DEVELOPMENT
R. W. Mayne *In* Shock and Vibration Inform. Center, The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 25-33 refs (For primary document see N80-24250 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

N80-24256 Birla Inst. of Technology and Science, Pilani (India).
A SURVEY OF STRUCTURAL OPTIMIZATION UNDER DYNAMIC CONSTRAINTS
M. A. V. Rangacharyulu and G. T. S. Done (City Univ., London) *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 15-25 refs (For primary document see N80-24254 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

42 GEOSCIENCES (GENERAL)

N80-23710# Oak Ridge National Lab., Tenn. Environmental Science Div.
MODELING THE CIRCULATION OF CARBON IN THE WORLD'S TERRESTRIAL ECOSYSTEMS
W. R. Emanuel, G. G. Killough, and J. S. Olson 1979 40 p refs
(Contract W-7405-eng-26; Grant NSF DEB-77-26722)
(DOE/TIC-10293) Avail: NTIS HC A03/MF A01

A mathematical model for the circulation of carbon in the world terrestrial ecosystems is proposed. A five compartment representation is developed which corresponds to the functional components studied by field ecologists. Rate coefficients for this linear dynamic model are calculated from estimates of the 1970 standing crop and compartment exchanges of carbon. The model is analyzed in terms of response to a unit impulse, thereby displaying a transient time distribution. The response to a hypothetical pulse input through gross primary production is also simulated, illustrating the efficiency of the terrestrial carbon system in transferring carbon into longer storage components. The concept of CO2 fertilization is examined by allowing gross primary production to increase in response to higher atmosphere concentrations. DOE

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N80-23711* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COAL-SHALE INTERFACE DETECTOR Patent
Harry Reid, Jr., inventor (to NASA) Issued 1 Apr. 1980 8 p Filed 3 Nov. 1977
(NASA-Case-MFS-23720-1; US-Patent-4,195,512; US-Patent-Appl-SN-848419; US-Patent-Class-73-12; US-Patent-Class-73-82) Avail: US Patent and Trademark Office CSCL 08I

A coal-shale interface detector for use with coal cutting equipment is described. The detector consists of a reciprocating hammer with an accelerometer to measure the impact of the hammer as it penetrates the ceiling or floor surface of a mine. Additionally, a pair of reflectometers simultaneously view the same surface, and the outputs from the accelerometer and reflectometers are detected and jointly registered to determine when an interface between coal and shale is being cut through.
Official Gazette of the U.S. Patent and Trademark Office

N80-23712 Utah Univ., Salt Lake City.
CATEGORIZATION OF WATERSHED LAND COVER UNITS WITH LANDSAT DATA Ph.D. Thesis
Thomas Delane Frank 1979 187 p
Avail: Univ. Microfilms Order No. 8010660

Unsupervised training procedures were used to statistically and spatially analyze spectral variation in LANDSAT-2 MSS data for a semiarid watershed in east-central Utah. Categorization of the signatures was accomplished with a factor analysis procedure. Interclass distances among all signatures were computed, and a standardization distance matrix entered into an oblique factor analysis. Factors derived from the reduction of interclass similarities among signatures were interpreted as core land cover categories. Each of the land cover categories is an integrated terrain unit, consisting of similar vegetation and surface geology. The optimum number of integrated terrain units is readily determined. Categorization of signatures with this methodology allows a researcher to evaluate the adequacy of the signatures generated in an unsupervised training approach to actually represent land cover variation. If the optimum number of land cover categories is not known prior to classification of LANDSAT data, the basic number as represented in the LANDSAT signatures, is identified by this method which contributes to the labelling and categorization of individual signatures to the core land cover categories. Dissert. Abstr.

N80-23713 Pennsylvania State Univ., University Park.
HYDROLOGIC EVALUATION OF THE STORMFLOW GENERATION PROCESS ON A FORESTED WATERSHED Ph.D. Thesis
Edward Sisk Corbett 1979 149 p
Avail: Univ. Microfilms Order No. 8010041

An irrigation system was designed to apply a uniform amount of simulated rainfall to parts or all of a 19.59 acre experimental watershed in central Pennsylvania. To delineate the stormflow contributing areas and to evaluate their relative efficiency in converting rainfall into stormflow, a series of simulated rainfall applications were made, starting with the channel area and progressively increasing the application areas up the side slopes. The applications were made at both dry and wet antecedent soil moisture conditions and at three primary application amounts, 0.96, 1.50, and 1.92 inches. All rainfall applications were made at the rate of 0.24 inches per hour. There was a rapid reduction in the efficiency with which rainfall is converted to stormflow as distance from the perennial stream channel increases under dry antecedent soil moisture conditions. Under wet antecedent soil moisture conditions the watershed contributes to stormflow in a more uniform manner and the stormflow components becomes highly correlated with storm amount. There was large increase in the efficiency with which the middle and upper slope soil zones converted rainfall into quickflow as positive hydraulic gradients became established in these areas of the watershed.
Dissert. Abstr.

N80-23714 Colorado Univ. at Boulder.
LAND USE INTENSITY AND WATER QUALITY Ph.D. Thesis
Donald William Duckson, Jr. 1979 181 p
Avail: Univ. Microfilms Order No. 8011272

The relationship between land use and water quality in three watersheds tributary to the Potomac is as examined. Specfically concomitant changes in water quality which result from land use alterations were determined. A predictive device for estimating the rate and direction fo water quality changes brought about by a mosaic of land uses which themselves, are in flux, was developed. Mosaics of land uses were evaluated using and empirically-derived index of land use intensity. Index values were used as the independent varible in a series of regression equations which dissolved oxygen, pH, total dissolved solids, total iron, and total hardness (EDTA) were dependent varibles. Regressions provided statistically significant results only for TDS, iron, and hardness and indicate a predictable rate of change for selected water quality parameters with changes in the intensity of land use. No distinction between classes of land use was possible.
Dissert. Abstr.

N80-23715*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): USER'S GUIDE
A. M. Fails, Principal Investigator Dec. 1979 77 p ERTS
(Contract NAS9-15800)
(E80-10088; NASA-CR-160531; LEC-14286; JSC-16436)
Avail: NTIS HC A04/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-23716*# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
A METHOD FOR CLASSIFYING MULTISPECTRAL REMOTE SENSING DATA USING CONTEXT
Philip H. Swain, Howard J. Siegel, and Bradley W. Smith, Principal Investigators 1979 11 p refs Presented at the Machine Process of Remotely Sensed Data Symp., 1979 ERTS
(Contract NAS9-15466)
(E80-10089; NASA-CR-160477; Rept-062379) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23717*# Lockheed Electronics Co., Houston, Tex.
OPERATIONS MANUAL FOR THE LANDSAT IMAGERY, VERIFICATION AND EXTRACTION SYSTEM (LIVES)
L. E. Giddings, Principal Investigator Aug. 1979 83 p ERTS
(Contract NAS9-15800)
(E80-10090; NASA-CR-160475; LEC-12903; JSC-14633)
Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23718*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
USERS MANUAL FOR THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)
L. E. Giddings, Principal Investigator Aug. 1979 52 p ERTS
(Contract NAS9-15800)
(E80-10091; NASA-CR-160474; LEC-12902; JSC-14632)
Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23719*# National Governors Association/Council of State Planning Agencies, Washington, D. C.
EARTH RESOURCES DATA PROJECT Final Report, 1 Aug. - 30 Sep. 1979
Feb. 1980 96 p ERTS
(Contract NASw-3140)
(E80-10092; NASA-CR-162802) Avail: NTIS HC A05/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23720*# Lockheed Electronics Co., Houston, Tex.
CROP PHENOLOGY LITERATURE REVIEW FOR CORN, SOYBEAN, WHEAT, BARLEY, SORGHUM, RICE, COTTON, AND SUNFLOWER
T. Hodges and P. C. Doraiswamy, Principal Investigators Nov. 1979 90 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for Intern. Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10093; NASA-CR-160469; SR-L9-00409; LEC-13722; JSC-16088) Avail: NTIS HC A05/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-23721*# Fort Lewis A&M Coll., Durango, Colo.
DEVELOPMENT OF A WINTER WHEAT ADJUSTABLE CROP CALENDAR MODEL Final Report
James R. Baker, Principal Investigator 31 Dec. 1979 83 p refs ERTS
(Contract NAS9-15276)
(E80-10094; NASA-CR-160447) Avail: NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results. Least squares techniques were applied for parameter estimation of functions to predict winter wheat phenological stage with daily maximum temperature, minimum temperature, daylength, and precipitation as independent variables. After parameter estimation, tests were conducted using independent data. It may generally be concluded that exponential functions have little advantage over polynomials. Precipitation was not found to significantly affect the fits. The Robertson triquadratic form, in general use for spring wheat, yielded good results, but special techniques and care are required. In most instances, equations with nonlinear effects were found to yield erratic results when utilized with averaged daily environmental values as independent variables.

N80-23722*# Council of State Governments, Lexington, Ky.
INTEGRATED USE OF LANDSAT DATA FOR STATE RESOURCE MANAGEMENT
William G. Schneider, Jr., Principal Investigator 1979 41 p refs ERTS
(Contract NASw-3140)
(E80-10095; NASA-CR-162809) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23723*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): UNIVAL SOFTWARE USER'S GUIDE
A. S. Story and M. V. Martin, Principal Investigators Dec. 1979 55 p ERTS
(Contract NAS9-15800)
(E80-10096; NASA-CR-160532; LEC-14287; JSC-16437) Avail: NTIS HC A04/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-23724*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEXAS NATURAL RESOURCES INVENTORY AND MONITORING SYSTEM (TNRIMS), APPLICATIONS SYSTEM VERIFICATION AND TRANSFER (ASVT), REMOTE SENSING INFORMATION SUBSYSTEM (RSIS): ACCEPTANCE TEST PROCEDURES
M. L. Brown, M. V. Martin, and A. S. Story, Principal Investigators Dec. 1979 52 p ERTS
(Contract NAS9-15800)
(E80-10097; NASA-CR-160533; LEC-14288; JSC-16438) Avail: NTIS HC A04/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-23725*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
AGRICULTURAL SOIL MOISTURE EXPERIMENT: 1978 COLBY (KANSAS) DATA CATALOG AND DOCUMENTATION
B. W. Milstead, Principal Investigator Sep. 1979 176 p refs ERTS
(Contract NAS9-15800)
(E80-10098; NASA-CR-160473; LEC-13226; JSC-16229) Avail: NTIS HC A09/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-23726*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
VARIABILITY OF CROP CALENDAR STAGE DATES
M. L. Sestak, T. Hodges, and J. A. Artley, Principal Investigators Jan. 1980 23 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10099; NASA-CR-160468; LEMSCO-14070; SR-L0-00416; JSC-16309) Avail: NTIS HC A02/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-23727*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM: CORRECTIONS TO FOREST REFLECTANCE AS A FUNCTION OF LOW SUN ANGLE AND SLOPE
W. H. Echert and C. E. Campbell, Principal Investigators Jun. 1979 36 p refs Sponsored in part by USDA ERTS
(Contract NAS9-15800)
(E80-10100; NASA-CR-160470; LEC-13188) Avail: NTIS HC A03/MF A01 CSCL 02F

There are no author-identified significant results in this report.

N80-23728*# National Governors Association/Council of State Planning Agencies, Washington, D. C.
LANDSAT'S ROLE IN STATE COASTAL MANAGEMENT PROGRAMS
Oct. 1979 18 p Sponsored by NASA ERTS
(E80-10101; NASA-CR-162810) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23729*# National Governors Association/Council of State Planning Agencies, Washington, D. C.
LANDSAT'S ROLE IN HUD 701 PROGRAMS
Oct. 1979 15 p Sponsored by NASA ERTS
(E80-10102; NASA-CR-162811) Avail: NTIS HC A02/MF A01 CSCL 05B

There are no author-indentified significant results in this report.

N80-23730*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LANDSAT RECONNAISSANCE IMAGES OF THE GREAT SOIL REGION IN THE WESTERN PART OF THE PARAIBA BASIN [RECONHECIMENTO DOS GRANDES DOMINIOS PEDOLOGICOS DA BACIA DO PARAIBA (PARTE OCIDENTAL) ATRAVES DE IMAGENS LANDSAT]
Nelson DeJesusParada, Principal Investigator, Mario Valerio Filho, Jose Pereira deQueirozNeto, Natalio Felipe Koffler, Paulo Nakashima, Juercio Tavares deMattos, Nilton Tocicazu Higa, and Vitor Celso deCarvalho Nov. 1979 55 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E80-10103; NASA-CR-162812; INPE-1623-RPE/088) Avail: NTIS HC A04/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23731*# Purdue Univ., Lafayette, Ind.
SAMPLING FOR AREA ESTIMATION: A COMPARISON OF FULL-FRAME SAMPLING WITH THE SAMPLE SEGMENT APPROACH
Marilyn Hixson, Marvin E. Bauer, and Barbara J. Davis, Principal Investigators (Bell Telephone Co., Indianapolis) 1979 8 p refs Presented at the Machine Process. of Remotely Sensed Data Symp., 1979 ERTS
(Contract NAS9-14970)
(E80-10104; NASA-CR-160479; Rept-06277) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. Full-frame classifications of wheat and non-wheat for eighty counties in Kansas were repetitively sampled to simulate alternative sampling plans. Evaluation of four sampling schemes involving different numbers of samples and different size sampling units shows that the precision of the wheat estimates increased as the segment size decreased and the number of segments

was increased. Although the average bias associated with the various sampling schemes was not significantly different, the maximum absolute bias was directly related to sampling size unit.

N80-23732*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
EVALUATION OF SEVERAL SCHEMES FOR CLASSIFICATION OF REMOTELY SENSED DATA: THEIR PARAMETERS AND PERFORMANCE
Donna Scholz, Nancy Fuhs, Marilyn Hixson, and Tsuyoshi Akiyama, Principal Investigators 1979 14 p refs ERTS
(Contract NAS9-15466)
(E80-10105; NASA-CR-160478; LARS-TR-041279) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. Data sets for corn, soybeans, winter wheat, and spring wheat were used to evaluate the following schemes for crop identification: (1) per point Gaussian maximum classifier; (2) per point sum of normal densities classifiers; (3) per point linear classifier; (4) per point Gaussian maximum likelihood decision tree classifiers; and (5) texture sensitive per field Gaussian maximum likelihood classifier. Test site location and classifier both had significant effects on classification accuracy of small grains; classifiers did not differ significantly in overall accuracy, with the majority of the difference among classifiers being attributed to training method rather than to the classification algorithm applied. The complexity of use and computer costs for the classifiers varied significantly. A linear classification rule which assigns each pixel to the class whose mean is closest in Euclidean distance was the easiest for the analyst and cost the least per classification.

N80-23733*# Department of Agriculture, Weslaco, Tex. Science and Education Administration.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Dec. 1979 - 1 Mar. 1980
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Mar. 1980 9 p HCMM
(Contract NASA Order S-40198-B)
(E80-10106; NASA-CR-162817) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. HCMM day/night coverage 12 hours apart cannot be obtained at 26 deg N latitude; nor have any pairs 36 hours apart been obtained. A day-IR scene and a night scene for two different dates were analyzed. A profile across the test site for the same latitude shows that the two profiles are near mirror images of each other over land surfaces and that the temperature of two large water bodies, Falcon Reservoir and the Gulf of Mexico, are nearly identical on two dates. During the time interval between overpasses, the vegetative cover remained static due to winter dormancy. The data suggest that day/night temperature differences measured weeks apart may yield meaningful information about the contrast between daytime maximum and nighttime minimum temperatures for a given site.

N80-23734*# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
APPLICATION EXPLORER MISSION A: HEAT CAPACITY MAPPING MISSION
R. Haydn, Principal Investigator [1979] 3 p Sponsored by NASA HCMM
(E80-10107; NASA-CR-162818) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-23735*# Consiglio Nazionale delle Ricerche, Milan (Italy). Istituto per la Geofisica della Litosfera.
STUDY OF GEOLOGICAL STRUCTURE OF SICILY AND OTHER ITALIAN AREAS Progress Report
Robert Cassinis, Giovanni Maria Lechi, Principal Investigators, Pietro Alessandro Brivio, Renzo Moretti, and Eugenio Zilioli Jan. 1980 9 p Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(E80-10108; NASA-CR-162819; RN-304; PR-2) Avail: NTIS HC A02/MF A01 CSCL 08B

There are no author-identified significant results in this report.

N80-23736*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTEGRATED SURVEYS OF THE NATURAL RESOURCES IN THE AMAZONIA NATIONAL PARK (TOPAJOS) BASED ON LANDSAT IMAGES [LEVANTAMENTO INTEGRADO DOS RECURSOS NATURAIS DA AREA DO PARQUE NACIONAL DA AMAZONIA (TAPAJOS), BASEADO NAS IMAGENS MSS DO LANDSAT]
Nelson deJesusParada, Principal Investigator, Joaquim Henrique Duran Pinto, Joao Roberto dosSantos, Liu Chan Chiang, Madalena Nierb, Sergio dosAnjos Ferreira Pinto, and Vitor Celso deCarvalho Sep. 1979 59 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains color illustrations ERTS
(E80-10109; NASA-CR-162820; INPE-1577-RPE/074) Avail: NTIS HC A04/MF A01 CSCL 08F

There are no author-identified significant results in this report.

N80-23737*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AUTOMATIC INTERPRETATION OF LANDSAT DATA TO CHARACTERIZE THE DISPERSION OF SUSPENDED SEDIMENTS IN ARTIFICIAL RESERVOIRS [ANALISE AUTOMATICA DE DADOS LANDSAT NO ESTUDO DA DISPERSAO DE SEDIMENTOS EM SUSPENSAO EM RESERVATORIOUS ARTIFICIAIS]
Nelson deJesusParada, Tania Maria Sausen, and Vitor Celso deCarvalho, Principal Investigators Sep. 1979 40 p refs In PORTUGUESE; ENGLISH summary Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E80-10110; NASA-CR-162821; INPE-1572-RPE/071) Avail: NTIS HC A03/MF A01 CSCL 05B

There are no author-identified significant results in this report.

N80-23738*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Status Report, 1 Dec. 1978 - 31 May 1979
R. A. Weismiller and R. P. Mroczynski, Principal Investigators 31 May 1979 32 p refs ERTS
(Grant NGL-15-005-186)
(E80-10111; NASA-CR-162853; LARS-053079) Avail: NTIS HC A03/MF A01 CSCL 05A

There are no author-identified significant results in this report.

N80-23739*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
APPLICABILITY OF SELECTED WHEAT REMOTE SENSING TECHNOLOGY TO CORN AND SOYBEANS Final Report, 1 Nov. 1978 - 30 Nov. 1979
Quentin A. Holmes, William A. Malila, Principal Investigators, D. P. Rice, and E. P. Crist Jan. 1980 38 p refs ERTS
(Contract NAS9-15082)
(E80-10112; NASA-CR-160546; ERIM-124000-9-F) Avail: NTIS HC A03/MF A01 CSCL 02C

There are no author-identified significant results in this report.

N80-23740*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
AGRICULTURAL SCENE UNDERSTANDING AND SUPPORTING FIELD RESEARCH, VOLUME 1 Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, M. E. Bauer, L. L. Biehl, C. S. T. Daughtry, B. F. Robinson, and E. R. Stover Nov. 1979

140 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development. ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10113; NASA-CR-160547; SR-P9-00410;
LARS-112879) Avail: NTIS HC A07/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23741*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PROCESSING TECHNIQUES DEVELOPMENT, VOLUME 2. PART 1: CROP INVENTORY TECHNIQUES Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, C. S. T. Daughtry, and M. M. Hixson Nov. 1979 76 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10114; NASA-CR-160548; SR-P9-00411;
LARS-112979) Avail: NTIS HC A05/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23742*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
PROCESSING TECHNIQUES DEVELOPMENT, VOLUME 3. PART 2: DATA PREPROCESSING AND INFORMATION EXTRACTION TECHNIQUES Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, P. H. Swain, P. E. Anuta, and H. J. Siegel Nov. 1979 155 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10115; NASA-CR-160549; SR-P9-00412;
LARS-113079) Avail: NTIS HC A08/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-23743*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
COMPUTER PROCESSING SUPPORT, VOLUME 4 Final Report, 1 Dec. 1978 - 30 Nov. 1979
D. A. Landgrebe, Principal Investigator, J. L. Kast, L. A. Kraemer, B. M. Shelley, S. K. Schwingendorf, and T. L. Phillips Nov. 1979 136 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for Intern. Development ERTS
(Contract NAS9-15466; Proj. AgRISTARS)
(E80-10116; NASA-CR-160550; SR-P9-00413;
LARJ-120179) Avail: NTIS HC A07/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23744*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
CORN/SOYBEAN DECISION LOGIC: IMPROVEMENTS AND NEW CROPS
C. L. Dailey, K. M. Abotteen, and J. D. Nichols, Principal Investigators Jan. 1980 91 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10118; NASA-CR-160543; FC-Lo-00420;
LEMSCO-14084; JSC-16301) Avail: NTIS HC A05/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23745*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
INTERPRETATION OF LANDSAT DIGITAL DATA USING A CUBIC COLOR MODEL BASED ON RELATIVE ENERGIES
R. B. Cate, D. E. Phinney, M. C. Kinsler, M. L. Sestak, T. Hodges, and J. J. Dishler, Principal Investigators Feb. 1980 31 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10119; NASA-CR-160541; SR-L0-00418;
LEMSCO-13499) Avail: NTIS HC A03/MF A01 CSCL 05B
There are no author-identified significant results in this report.

N80-23746*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
NEUTRON-METER CALIBRATION FOR THE 1978 COLBY SOIL MOISTURE EXPERIMENT
Lalit M. Arya, Principal Investigator Feb. 1980 37 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10120; NASA-CR-160553; SR-L0-00415;
LEMSCO-14082; JSC-13775) Avail: NTIS HC A03/MF A01 CSCL 08M
There are no author-identified significant results in this report.

N80-23747*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
COMPOSITION AND ASSEMBLY OF A SPECTRAL DATA BASE FOR TRANSITION YEAR SPRING WHEAT BLIND SITES
M. H. Trenchard, M. L. Sestak, and M. C. Kinsler, Principal Investigators Jan. 1980 114 p ref Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10121; NASA-CR-160544; SR-L0-00417;
LEMSCO-14069; JSC-16273) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23748*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
CROP YIELD LITERATURE REVIEW FOR AGRISTARS CROPS: CORN, SOYBEANS, WHEAT, BARLEY, SORGHUM, RICE, COTTON, AND SUNFLOWERS
P. C. Doraiswamy, T. Hodges, and D. E. Phinney, Principal Investigators Dec. 1979 106 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS
(Contract NAS9-15800; Proj. AgRISTARS)
(E80-10122; NASA-CR-160542; SR-L9-00405; LEC-13791;
JSC-16320) Avail: NTIS HC A06/MF A01 CSCL 02C
There are no author-identified significant results in this report.

N80-23749# Army Engineer Topographic Labs., Fort Belvoir, Va.
RESEARCH FOR INFORMATION EXTRACTION FROM AERIAL IMAGERY
Robert D. Leighty Oct. 1979 14 p refs Presented at the Remote Sensing Symp., Ft. Belvoir, Va., 29-31 Oct. 1979
(AD-A080744; ETL-R001) Avail: NTIS HC A02/MF A01 CSCL 05/8

The U.S. Army Engineer Topographic Laboratories is investigating a number of approaches to information extraction from aerial imagery. Two approaches will be discussed in this paper: automated feature extraction research and computer-assisted photo interpretation research. The discussion of automated information extraction indicates present day capabilities of automated systems, problems facing automated information extraction, and directions which basic research must take to achieve automated 'smart analysis systems' in the distant future. The discussion of computer-assisted photo interpretation will describe the research system now being developed and experiments for research which is expected to have value in the near future for increasing the quality and efficiency of the total information extraction processes. GRA

N80-23750# Defense Mapping Agency, Washington, D.C.
AUTOMATION IN PHOTOGRAMMETRY
James B. Case 25 Jul. 1980 14 p refs
(AD-A081562) Avail: NTIS HC A02/MF A01 CSCL 08/2

All functional aspects of photogrammetry, i.e., triangulation mensuration, elevation data extraction, planimetric data extraction, and rectification and orthorectification, are now being automated to some degree. Automation extends from computer control of comparators and analog stereo plotters, through the analytical stereoplotters, to orthophoto printers and fully automated correlation equipment. The drive towards automation has been triggered not only by the continuing necessity to reduce costs, but also by the need to generate new products (e.g., DTM, land use, etc.) and to utilize other than conventional mapping photography. These have led, in turn, to the necessity for data editing and data management systems. The trend in the future will be towards the ever-increasing use of digital image processing technology. Examples of several levels of automation in photogrammetry are described. GRA

N80-23751# Army Engineer Studies Center, Washington, D. C. Computer Sciences Lab.
APPLICATIONS OF DIGITAL DISPLAY IN PHOTOINTERPRETATION AND DIGITAL MAPPING
Bryce L. Schrock Jan. 1980 15 p refs
(AD-A081091; ETL-R004) Avail: NTIS HC A02/MF A01 CSCL 09/2

The Digital Image Analysis Laboratory (DIAL) at USAETL is a large-scale interactive system designed for research and development activities in digital image processing. The system has been successfully applied to a variety of investigations in both digital mapping and photointerpretation as described in this presentation. Recently a Demonstration Image Processing System (DEMONS) has been added to the DIAL system to serve as a high-speed work station for processing very large digital images. Although DEMONS has been reasonably successful in manipulating large images, its limitations indicate that future such systems might be hybrid systems combining the best features of both hardcopy (film) and softcopy (cathode ray tube) exploitation systems. GRA

N80-23752# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
OCEANOGRAPHIC REMOTE SENSING: A POSITION PAPER
R. Goodman, J. Bailey, J. Gallagher, R. Kirk, R. Nagle, V. Moble, A. Pressman, and K. VanSickle 26 Jan. 1979 26 p
(AD-A081494) Avail: NTIS HC A03/MF A01 CSCL 22/2

The purpose of a Navy R D remote sensing plan should be to set forth the requirements and direction of basic and exploratory research in satellite remote sensing which supports the overall Navy oceanographic research and operational programs. The aim of the plan would be to outline the established requirements, objectives, current and planned research programs necessary to achieve the ultimate goals of improved environmental support to the fleet. While the plan will be primarily directed toward 6.1 and 6.2 programs, appropriate consideration for coordination of 6.3 - 6.6 requirements should be addressed. The plan should help serve as a single technology and program reference for implementation and planning of Navy related satellite remote sensing programs. Fundamentally, the plan would: (1) set forth the manner and rate with which the Navy research program should proceed in order to successfully exploit environmental satellite systems supporting Navy and DOD oceanographic requirements, (2) provide guidance to the Assistant Secretary of the Navy for Research, Engineering and Systems (ASNRES) and the Chief of Naval Research in overall program planning, (3) provide research programs which will support the objective of the Naval Oceanographic and Meteorological Support System (NOMSS) Environmental Satellite Plan for predictions for Naval operations. GRA

N80-23753# Army Engineer Topographic Labs., Fort Belvoir, Va.
DIGITAL SCREENING AND HALFTONE TECHNIQUES FOR RASTER PROCESSING
Richard L. Rosenthal 14 Jan. 1980 13 p refs
(AD-A081090; ETL-R003) Avail: NTIS HC A02/MF A01 CSCL 14/5

The development of raster processing programs at USAETL has included programs for the generation of raster plot data containing cartographically symbolized features as well as the more widely investigated raster-to-vector software. Raster plot data may be used to generate film negatives with open window areas over which mechanical screens can be placed by conventional contact printing techniques. These areas can also be filled with digitally generated screens, a capability unique with the raster approach. Further, since most available raster plotting hardware does not permit the modulation of each pixel for intensity, it is desirable to control groups of pixels in order to approximate a halftone dot for color or density control. A study was made to determine the suitability of the 25 micron pixel raster on the Digital Laser Platemaker for the generation of digital screens for absolute color and process color printing. Tests will be conducted to establish screen pattern and angle criteria to achieve desired results without moire. An associated literature search resulted in a fairly comprehensive bibliography of work published in the digital screening field. GRA

N80-23754# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
REMOTE SENSING OF AQUATIC PLANTS Final Report, Sep. 1975 - Sep. 1977
Katherine S. Long Oct. 1979 103 p refs
(AD-A081737; WES-TR-A-79-2) Avail: NTIS HC A06/MF A01 CSCL 14/5

This report summarizes a 3 year effort in evaluating the various available remote sensing methods for identification and assessment of expanses of aquatic plants. Both materials and techniques are examined for cost effectiveness and capability to sense aquatic plants on both the local and regional scales. Computer simulation of photographic responses was employed; LANDSAT, high-altitude photography, side-looking airborne radar, and low-altitude photography were examined to determine the capabilities of each for identifying and assessing aquatic plants. Results of the study revealed LANDSAT to be the most cost effective for regional surveys, although its coarse resolution would be limiting in some cases. High-quality, high-altitude false-color infrared film showed great potential for species identification. Model studies borne out by field demonstrations showed black-and-white infrared photography to have a strong potential for discriminating infested from uninfested areas, with less associated cost than when false-color infrared is used. False-color infrared does show the greatest potential for discriminating among species. Ground-truth information concerning a specific area aids materially in the mapping. Examples of photographs, maps, and cost analyses of two demonstration projects conducted at Lake Marion, South Carolina, and Lake Seminole Florida, are included. GRA

N80-23755# Geokinetics, Inc., Concord, Calif.
GEOKINETICS IN SITU SHALE OIL RECOVERY PROJECT Annual Report, Mar. 1979
Mar. 1979 61 p
(Contracts ET-78-F-03-1787; DE-FC20-78LC-0787)
(LETC-10787-25; AR-2) Avail: NTIS HC A04/MF A01

Eighteen in situ retorts were constructed, ranging in size from 330 tons to 46,000 tons. Eleven of these retorts were burned, and a total of 5400 barrels of shale oil were recovered. Oil shale thicknesses of 30 feet, and cross-sectional areas of 3800 square feet were successfully blasted. The results are encouraging, and the project will continue to scale up its size of the operation in 1979. DOE

N80-23756# University of Southern California, Marina del Rey. Medical Imaging Sciences Group.
REMOTE SENSING FOR GEOTHERMAL ENVIRONMENTAL ASSESSMENTS Final Report
W. Frei, T. Shibata, and G. C. Huth 30 Jun. 1979 35 p refs Sponsored in part by California Univ., Lawrence Livermore Lab.
(Contract W-7405-eng-48)
(UCRL-15108) Avail: NTIS HC A03/MF A01

The role of remote sensing is examined in the context of the DOE Environmental Assessment Studies. Particular attention is paid to the exploitation by computer analysis, of low altitude aerial photographs, which were made available for this project.

One technique, change detection, developed during this project, was found to be particularly useful because it permits the detection of environmental changes at a very early stage where it might escape detection on the ground. This technique, which was perfected for use on a routine basis, can thus provide a very effective environmental early warning capability. Several examples are shown in known Geothermal Resource Areas (KGRA's) in the Imperial Valley and the Geysers, California, which lead to the conclusion that remote sensing become an essential tool for the Environmental Assessment Studies. DOE

N80-23757# National Bureau of Standards, Boulder, Colo. Electromagnetic Fields Div.
DEVELOPMENT AND TESTING OF A MICROWAVE SYSTEM TO MEASURE COAL LAYER THICKNESS UP TO 25 cm
K. C. Roe and D. A. Ellerbruch Jan. 1979 27 p refs
(Contract ET-77-I-01-8881)
(FE-8881-1; SR-723-8-79) Avail: NTIS HC A03/MF A01

The design, construction and testing of a microwave coal thickness indicator built to demonstrate the hypothesis that an electromagnetic coal interface detector (EMCID) corrected for surface admittance variation can measure coal thickness up to 25 cm within + or - 10 percent accuracy is described. The design is based upon the FM-CW radar technique where reflections from layered strata are detected in time relationship to propagation path lengths. Relative depths to layered strata are displayed in numerical digits. Determining the thickness of the coal layer left on mine-haulageway roofs is important for both mine safety and maximum coal recovery. A specified thickness is required in many mines to maintain roof strength and to prevent exposure of the overlying slate or shale to air, which deteriorates slate and shale. DOE

N80-23758# California Univ., Livermore. Lawrence Livermore Lab.
CHABOT OBSERVATORY REMOTE SENSING EXPERIMENTS (CORSE) Progress Report, 1978 - 1979
W. M. Porch, T. R. Galloway, T. J. Greene, J. O. Waidl, and P. T. Fotsholer Jan. 1980 30 p refs
(Contract W-7405-eng-48)
(UCID-18504) Avail: NTIS HC A03/MF A01

A cooperative effort yielded several important results and new techniques for remote sensing of atmospheric parameters. An electro-optical system was developed which simultaneously analyzes regional scale atmospheric constituents such as aerosols H2O, O2, NO2, and O3 while measuring long path averaged wind and atmospheric turbulence in the San Francisco Bay Area. Improvement of these techniques will permit the remote determination of vertical temperature profiles inversion heights, heat fluxes and vertical gradient wind speeds. DOE

N80-23759# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
REMOTE SENSING METHODS FOR DETERMINATION OF SLANT RANGE VISIBILITY
Christian Werner Mar. 1979 49 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-627)
(DFVLR-FB-79-14) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 8,70

The various known methods for the determination of the slant visual range are reviewed and compared. Emphasis is placed on a discussion of laser radar systems for use in aircraft landing operations. Based on considerations related to accuracy and technical complexity, a measurement method is proposed for visibility distances of up to 1500 m and altitudes of 100 m. Author (ESA)

N80-23760# Amsterdam Univ. (Netherlands). Lab. of Physical Geography.
POINTBARS: A COMPARATIVE EXAMINATION ALONG THE LARGE DUTCH RIVERS [POINTBARS: EEN VERGELIJKEND ONDERZOEK LANGS DE NEDERLANDSE GROTE RIVIEREN]
N. Boekhorst, H. Duimelaar, K. Jurrians, J. vanderMeer, B. Meijer, R. Smit, L. Taekema, and N. vanVeen 1977 67 p refs In DUTCH
(Rept-2) Avail: NTIS HC A04/MF A01

Pointbars were studied in the vicinity of the rivers Yssel, Waal, and Maas. The method of study is described, including field work and data processing. The genesis of pointbars is treated in the form of a literature study. The three regions are compared, and the age of the pointbars discussed. Author (ESA)

N80-23761# Amsterdam Univ. (Netherlands). Lab. of Physical Geography.
VOORNE-PUTTEN: A LANDSCAPE-ECOLOGICAL SURVEY [VOORNE-PUTTEN: EEN LANDSCHAPSECOLOGISCH ONDERZOEK]
T. W. M. Levelt, A. J. J. Bolt, C. Kwakernaak, and A. P. A. Vink 1978 123 p refs In DUTCH
(Rept-4) Avail: NTIS HC A06/MF A01

A land-use plan for part of the Rhine delta is presented. The methodology of the surveys is described. Changes in land utilization are shown, as determined by natural causes, as well as man-made incursions. Beaches and dunes are evaluated for their potential as recreation areas and bird sanctuaries, and a study made of the impact of urbanization. Author (ESA)

N80-23762# European Space Agency, Paris (France).
CLASSIFICATION OF MULTISPECTRAL REMOTE SENSING DATA
Peter Haberaecker Nov. 1979 64 p refs Transl. into ENGLISH of "Untersuchungen zur Klassifizierung Multispektraler Bilddaten aus der Fernerkundung", Rept. DLR-FB-77-72, Oberpfaffenhofen, West Germany, Jul. 1978 Original report in GERMAN previously announced as N79-30697 Original German report available from ZLDI, Munich DM 108,10 Original contains color illustrations
(ESA-TT-571; DLR-FB-77-72) Avail: NTIS HC A04/MF A01

Different concepts pertinent to classification are defined and a mathematical model, subsequently derived, is described. Various classifiers are theoretically considered. A synthetic and a natural scene, taken from a multispectral aerial photograph, are used to test and illustrate the efficiency of the various classifiers. Results are compared and performance criteria is evolved. Further algorithms are evaluated for feature selection and computation of indexes showing the a priori quality of classification. Finally, an example within the context of regional planning is examined using the classification of multitemporal image data. Author (ESA)

N80-23763# Department of the Army, Washington, D. C.
UNIVERSAL TRANSVERSE MERCATOR GRID TABLES FOR LATITUDES 0-80 DEGREES CLARKE 1866 SPHEROID (METERS). VOLUME 2: TRANSFORMATION OF COORDINATES FROM GRID TO GEOGRAPHIC
Jun. 1958 258 p Sponsored by NOAA
(PB80-140411; DA-TM-5-241-4/2; NOAA-80011603) Avail: NTIS HC A12/MF A01 CSCL 08B

Tables are presented to facilitate the transformation of coordinates, as well as the computation of scale factors and convergence of the meridians. All such computations consist essentially of the algebraic summation of the products of north-south factors by powers of east-west factors. The north-south factors are obtained by interpolation; the east-west factors are expressions of the distance from the central meridian. Certain factors of small and slow changing numerical value are expressed by graphs from which the desired term may be interpolated, using both the north-south and east-west factors as arguments. The tables give the following precisions: Grid coordinates to geographic coordinates + or - 0.001 second; convergence of the meridians; + or - 0.01 second; and reduction of lengths by scale factor; + or - in the seventh significant figure. GRA

N80-23764# Economics, Statistics and Cooperatives Service, Washington, D. C. Natural Resources Economics Div.
INTERPRETING LAND USE CHANGE THROUGH SATELLITE IMAGERY
Linda K. Lee Dec. 1979 24 p refs
(PB80-127277; AER-442) Avail: NTIS HC A02/MF A01 CSCL 08B

Employing a multiperiod approach to monitor land use change may compound the problems associated with interpretation of satellite imagery. Data from satellite imagery were used to

inventory new cropland development in the Great Plains and 85 counties in the Southeastern Alluvium Coast and Tidewater region between 1972 and 1976. Cloud cover problems, intensified by the two-period approach used, made data more difficult to interpret. Field checks were also more difficult because of the scattered and irregularly shaped land use change sites. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 85 Urban Technology and Transportation.*

N80-23765 Southern Methodist Univ., Dallas, Tex.
AMPHOTERIC GALLIUM ARSENIDE HETEROFACE SOLAR CELLS Ph.D. Thesis
Samuel Walter Beal 1979 124 p
Avail: Univ. Microfilms Order No. 8010704

The fabrication of a heteroface AlGaAs/GaAs solar cell by liquid phase epitaxy is presented. An amphoteric pn junction produced from a single GaAs:Si melt forms the base. A subsequent Al.85Ga.15As:Ge layer was deposited to provide an optical 'window' to the cell. The three layer structure was produced, then, from only two growth melts. The benefits of the window layer are demonstrated by spectral response comparisons. The efficiency is reported to be > 14 percent (1 AM1 sun). This is without an anti-reflection coating and does not account for the loss due to the contact area. The main advantage to this system is the improved minority carrier diffusion lengths obtained as compared to typical diffused-junction GaAs solar cell devices. The minority carrier properties were observed experimentally. The impurity profile was determined by capacitance measurements to be approximately linear and extending beyond the nominal depletion region boundary. The built-in electric field resulting from the grading in the quasi-neutral region was applied, for the first time, to the current mechanisms of a solar cell device. Dissert. Abstr.

N80-23766 Brown Univ., Providence, R. I.
SOLAR CELL HETEROJUNCTIONS INVOLVING N-CADMIUM SULFIDE AND CERTAIN P-TYPE SEMICONDUCTOR SINGLE CRYSTALS Ph.D. Thesis
Arienzo Maurizio 1979 214 p
Avail: Univ. Microfilms Order No. 8006969

The fabrication and testing of heterojunction photovoltaic solar cells of the type n-CdS/p-Ge, n-CdS/p-InP, n-CdS/p-GaAs and n-CdS/p-CdTe is described. The CdS layer was found to be single crystalline when it was grown on substrates whose lattice mismatch with CdS was less than 4%, i.e., in the case of growth on InP, GaAs and Ge. Analysis of the dark current characteristics revealed that in all of these heterojunction devices, there exists a low temperature, low bias voltage tunneling current. Analysis of the photovoltaic responses showed that they generally had respectable collection efficiencies; i.e., that the interface states did not act as recombination sites of photogenerated carries crossing the junction. The solar energy conversion efficiency is, however, strongly influenced by interface states through the open circuit voltage and the fill factor. A maximum conversion efficency without antireflection coating of 6.5% for n-CdS/p-InP under natural sunlight having an intensity of 74 mW/cm was observed. Dissert. Abstr.

N80-23767 Stanford Univ., Calif.
PROPERTIES OF SPUTTERED ITO/CdTe SOLAR CELLS Ph.D. Thesis
Francis Georges Courreges 1980 135 p
Avail: Univ. Microfilms Order No. 8011619

The properties of indium tin oxide/cadmium telluride (ITO/CdTe) solar cells prepared by RF sputtering of ITO on phosphorus-doped CdTe single crystals is investigated through measurements of dark and light current-voltage characteristics of ITO/CdTe heterojunctions and In/CdTe junctions and of surface photovoltage and photoluminescence of CdTe surfaces. An observed reduction in solar efficiency of ITO/CdTe solar cells with time and/or heat treatment is describable in terms of the change from a n(+)-ITO/n-CdTe/p-CdTe homojunction structure to a n(+)-ITO/p-CdTe heterojunction, characterized by high collection efficiency and poor rectifying properties. Dissert. Abstr.

N80-23768*# Westinghouse Research and Development Center, Pittsburgh, Pa.
CELL MODULE AND FUEL CONDITIONER DEVELOPMENT
D. Q. Hoover, Jr. Jan. 1980 58 p
(Contracts DEN3-161; DE-AI03-79ET-1272)
(NASA-CR-159828; DOE/NASA/0161-79/3; QR-1; Rept-80-9E6-MARED-R1) Avail: NTIS HC A04/MF A01

Components for the first 5 cell stack (no cooling plates) of the MK-2 design were fabricated. Preliminary specifications and designs for the components of a 23 cell MK-1 stack with four DIGAS cooling plates were developed. The MK-2 was selected as a bench mark design and a preliminary design of the facilities required for high rate manufacture of fuel cell modules was developed. Two stands for testing 5 cell stacks were built and design work for modifying existing stands and building new stands for 23 and 80 cell stacks was initiated. Design and procurement of components and materials for the catalyst test stand were completed and construction initiated. Work on the specifications of pipeline gas, tap water and recovered water and definition of equipment required for treatment was initiated. An innovative geometry for the reformer was conceived and modifications of the computer program to be used in its design were stated. R.E.S.

N80-23769*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CELL MODULE AND FUEL CONDITIONER Quarterly Report, Jan. - Mar. 1980
D. Q. Hoover, Jr. Apr. 1980 87 p
(Contracts DEN3-161; DE-AI03-79ET-11272)
(NASA-CR-159875; DOE/NASA/0161-2; QR-2) Avail: NTIS HC A05/MF A01 CSCL 10A

Stack tests indicate that the discrepancies between calculated and measured temperature profiles are due to reactant cross-over and a lower than expected thermal conductivity of cells. Preliminary results indicate that acceptable contact resistance between cooling plane halves can be achieved without the use of paper. The preliminary design of the enclosure, definition of required labor and equipment for manufacturing repeating components, and the assembly procedures for the benchwork design were developed. Fabrication of components for a second 5-cell stack of the MK-2 design and a second 23-cell stack of the MK-1 design was started. The definition of water and fuel for the reforming subsystem was developed along with a preliminary definition of the control system for the subsystem. The construction and shakedown of the differential catalytic reactor was completed and testing of the first catalyst initiated. R.E.S.

N80-23770*# Texas Instruments, Inc., Dallas.
AUTOMATED ARRAY ASSEMBLY, PHASE 2 Final Report
Bernard G. Carbajal Nov. 1979 43 p refs Sponsored in part by DOE Prepared for JPL
(Contracts NAS7-100; JPL-954881)
(NASA-CR-153191; DOE/JPL-954881-79-8; JPL-9950-319; Rept-03-79-58) Avail: NTIS HC A03/MF A01 CSCL 10A

Tasks of scaling up the tandem junction cell (TJC) from 2 cm x 2 cm to 6.2 cm and the assembly of several modules using these large area TJC's are described. The scale-up of the TJC was based on using the existing process and doing the necessary design activities to increase the cell area to an acceptably large area. The design was carried out using available device models. The design was verified and sample large area TJCs were fabricated. Mechanical and process problems occurred causing a schedule slippage that resulted in contract expiration before enough large-area TJCs were fabricated to populate the sample tandem junction modules (TJM). A TJM design was carried out in which the module interconnects served to augment the

current collecting buses on the cell. No sample TJMs were assembled due to a shortage of large-area TJCs. R.E.S.

N80-23771*# Spire Corp., Bedford, Mass.
DEVELOPMENT OF PULSED PROCESSES FOR THE MANUFACTURE OF SOLAR CELLS Final Report, Apr. 1979
J. A. Minnucci Apr. 1979 238 p refs Sponsored in part by DOE
(Contract JPL-954786)
(NASA-CR-153188; DOE/JPL-954786-79/02; JPL-9950-324; FR-79-10052) Avail: NTIS HC A11/MF A01 CSCL 10A

Low-energy ion implantation processes for the automated production of silicon solar cells were investigated. Phosphorus ions at an energy of 10 keV and dose of 2 x 10 to the 15th power/sq cm were implanted in silicon solar cells to produce junctions, while boron ions at 25 keV and 5 x 10 to the 15th power were implanted in the cells to produce effective back surface fields. An ion implantation facility with a beam current up to 4 mA and a production throughput of 300 wafers per hour was designed and installed. A design was prepared for a 100 mA, automated implanter with a production capacity of 100 MW sub e/sq cm per year. Two process sequences were developed which employ ion implantation and furnace or pulse annealing. A computer program was used to determine costs for junction formation by ion implantation and various furnace annealing cycles to demonstrate cost effectiveness of these methods. R.E.S.

N80-23772*# Solarex Corp., Rockville, Md.
ANALYSIS OF THE EFFECTS OF IMPURITIES IN SILICON Final Report, 19 Jan. 1979 - 31 Jan. 1980
J. H. Wohlgemuth and M. N. Giuliano 1980 95 p refs Sponsored in part by DOE
(Contract JPL-955307)
(NASA-CR-163133; DOE/JPL-955307; JPL-9950-325) Avail: NTIS HC A05/MF A01 CSCL 10A

A solar cell fabrication and analysis program was conducted to determine the effects on the resultant solar cell efficiency of impurities intentionally incorporated into silicon. It was found that certain impurities such as titanium, tantalum, and vanadium were bad, even in very small concentrations. Cell performance appeared relatively tolerable to impurities such as copper, carbon, calcium, chromium, iron and nickel (in the concentration levels which were considered). R.E.S.

N80-23773*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DEVELOPMENT AND FABRICATION OF A SOLAR CELL JUNCTION PROCESSING SYSTEM Quarterly Progress Report
Ward Halvason Apr. 1980 18 p Sponsored in part by DOE (Contracts NAS7-100; JPL-955640)
(NASA-CR-153194; DOE/JPL-955640-80/1; JPL-9950-329; QPR-10073-01; QR-1) Avail: NTIS HC A02/MF A01 CSCL 10A

Experiments were completed which indicate that single-pulse, liquid-phase epitaxial regrowth is the optimum technique for pulsed electron beam annealing of ion implantation damage in silicon wafers. An electron beam which covers the entire area of the wafer was chosen for the solar cell processor. Beam control experiments to improve beam propagation and to test the concept of partial space charge and current neutralization were initiated. The electrical parameters of the pulsed electron beam subsystem were chosen on the basis of computer calculations and past experience in pulsed electron accelerator design and operation. The pulser, designated SPI-PULSE 7000, is designed to anneal 10 cm diameter silicon wafers at a rate of 30 per minute. The preliminary design of the major elements of the SPI-PULSE 7000 was completed, and the detailed design of many of the components begun. These elements include a capacitive energy store and charging system, an electron accelerator, a beam control system, a wafer handling system and pressure and vacuum assemblies. R.E.S.

N80-23774*# Quality Inn of Key West, Miami Beach, Fla.
SOLAR HOT WATER SYSTEM INSTALLED AT QUALITY INN, KEY WEST, FLORIDA Final Report
Apr. 1980 25 p Sponsored in part by NASA
(Grant EG-77-G-01-1633)
(NASA-CR-161434) Avail: NTIS HC A02/MF A01 CSCL 10A

The solar energy hot water system installed in the Quality Inn, Key West, Florida, which consists of four buildings is described. Three buildings are low-rise, two-story buildings containing 100 rooms. The fourth is a four-story building with 48 rooms. The solar system was designed to provide approximately 50 percent of the energy required for the domestic hot water system. The solar system consists of approximately 1400 square feet of flat plate collector, two 500 gallon storage tanks, a circulating pump, and a controller. Operation of the system was begun in April 1978, and has continued to date with only three minor interruptions for pump repair. In the first year of operation, it was determined that the use of the solar facility resulted in forty percent fuel savings. R.E.S.

N80-23775*# General Electric Co., Philadelphia, Pa. Space Div.
MOD-1 WIND TURBINE GENERATOR ANALYSIS AND DESIGN REPORT, VOLUME 1 Final Report
Mar. 1979 320 p
(Contracts NAS3-20058; EX-77-A-29-1010)
(NASA-CR-159495; DOE/NASA/0058-79/2-Vol-1) Avail: NTIS HC A14/MF A01 CSCL 10A

The activities leading to the completion of detail design of the MOD-1 wind turbine generator are described. Emphasis is placed on the description of the design as it finally evolved. However, the steps through which the design progressed are also traced in order to understand the major design decisions. R.E.S.

N80-23776*# Gilbert (W. E.) and Associates, Inc., Greenwood, S.C.
SOLAR HEATING SYSTEM INSTALLED AT BLAKEDALE PROFESSIONAL CENTER, GREENWOOD, SOUTH CAROLINA Final Report
Mar. 1980 33 p Sponsored in part by NASA
(Contract EX-76-C-01-2389)
(NASA-CR-161435) Avail: NTIS HC A03/MF A01 CSCL 10B

Information on the solar heating system installed at the Blakedale Professional Center, in Greenwood, South Carolina is presented. The information consists of site and building description, solar system description, performance evaluation, system problems and installation drawings. The solar system was designed to provide approximately 85 percent of the building's heating requirements. The system was installed concurrently with building construction and heats 4,440 square feet of the building. There are 954 square feet of liquid flat plate collectors that are proof-mounted and have a drain-down system to protect the collectors from freezing. A 5,000 gallon steel, polyurethane insulated tank buried underground provides storage. The system was fully instrumented for performance evaluation and integrated into the National Solar Data Network. R.E.S.

N80-23777*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REDOX STORAGE SYSTEMS FOR SOLAR APPLICATIONS
Norman H. Hagedorn and Lawrence H. Thaller 1980 28 p refs Proposed for presentation at Power Sources Conf., Brighton, England, 15-18 Sep. 1980
(Contract EF-77-A-31-1002)
(NASA-TM-81464; DOE/NASA/1002-80/5; E-383) Avail: NTIS HC A03/MF A01 CSCL 10A

The NASA Redox energy storage system is described. The system is based on soluble aqueous iron and chromium chloride redox couples. The needed technology advances in the two elements (electrodes and membranes) that are key to its technological feasibility have been achieved and system development has begun. The design, construction, and test of a 1 kilowatt system integrated with a solar photovoltaic array is discussed. R.E.S.

N80-23778*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE OPTIMIZATION AIR SEPARATION PLANTS FOR

COMBINED CYCLE MHD-POWER PLANT APPLICATIONS
Albert J. Juhasz, Helmut Springmann, and Ralph Greenberg 1980 11 p refs Presented at the 7th Intern. Conf. on MHD Elec. Power Generation, Cambridge, Mass., 16-20 Jun. 1980
(Contracts DEN3-165; EF-77-A-01-2674)
(NASA-TM-81510; DOE/NASA/2674-80/10) Avail: NTIS HC A02/MF A01 CSCL 10B

Some of the design approaches being employed during a current supported study directed at developing an improved air separation process for the production of oxygen enriched air for magnetohydrodynamics (MHD) combustion are outlined. The ultimate objective is to arrive at conceptual designs of air separation plants, optimized for minimum specific power consumption and capital investment costs, for integration with MHD combined cycle power plants. R.E.S.

N80-23779*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE EFFECT OF CATALYST LENGTH AND DOWNSTREAM REACTOR DISTANCE ON CATALYTIC COMBUSTOR PERFORMANCE
David Anderson 1980 24 p refs Presented at the 4th Workshop on Catalytic Combust., Cincinnati, 14-15 May 1980; sponsored by EPA
(Contract EC-77-A-31-1040)
(NASA-TM-81475; DOE/NASA/1040-80/14; E-409) Avail: NTIS HC A02/MF A01 CSCL 10B

A study was made to determine the effects on catalytic combustor performance which resulted from independently varying the length of a catalytic reactor and the length available for gas-phase reactions downstream of the catalyst. Monolithic combustion catalysts from three manufacturers were tested in a combustion test rig with no. 2 diesel fuel. Catalytic reactor lengths of 2.5 and 5.4 cm, and downstream gas-phase reaction distances of 7.3, 12.4, 17.5, and 22.5 cm were evaluated. Measurements of carbon monoxide, unburned hydrocarbons, nitrogen oxides, and pressure drop were made. The catalytic-reactor pressure drop was less than 1 percent of the upstream total pressure for all test configurations and test conditions. Nitrogen oxides and unburned hydrocarbons emissions were less than 0.25 g NO2/kg fuel and 0.6 g HC/kg fuel, respectively. The minimum operating temperature (defined as the adiabatic combustion temperature required to obtain carbon monoxide emissions below a reference level of 13.6 g CO/kg fuel) ranged from 1230 K to 1500 K for the various conditions and configurations tested. The minimum operating temperature decreased with increasing total (catalytic-reactor-plus-downstream-gas-phase-reactor-zone) residence time but was independent of the relative times spent in each region when the catalytic-reactor residence time was greater than or equal to 1.4 ms. R.E.S.

N80-23780*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUMMARY AND EVALUATION OF THE PARAMETRIC STUDY OF POTENTIAL EARLY COMMERCIAL MHD POWER PLANTS (PSPEC)
Peter J. Staigner and John M. Abbott 1980 11 p refs Presented at the 7th Intern. Conf. on Magnetohydrodyn. Elec. Generation, Cambridge, Mass., 16-20 Jun. 1980; sponsored by the Symp. on the Eng. Aspects of Magnetohydrodynam., Inc.
(Contract EF-77-A-31-2674)
(NASA-TM-81497; DOE/NASA/2674-80/9; E-434) Avail: NTIS HC A02/MF A01 CSCL 10B

Two parallel contracted studies were conducted. Each contractor investigated three base cases and parametric variations about these base cases. Each contractor concluded that two of the base cases (a plant using separate firing of an advanced high temperature regenerative air heater with fuel from an advanced coal gasifier and a plant using an intermediate temperature metallic recuperative heat exchanger to heat oxygen enriched combustion air) were comparable in both performance and cost of electricity. The contractors differed in the level of their cost estimates with the capital cost estimates for the MHD topping cycle and the magnet subsystem in particular accounting for a significant part of the difference. The impact of the study on the decision to pursue a course which leads to an oxygen enriched plant as the first commercial MHD plant is described. R.E.S.

N80-23781# National Mechanical Engineering Research Inst., Pretoria (South Africa). Aeromechanics Div.
THE AERODYNAMICS OF AXIAL FLOW WIND POWER TURBINES
W. J. VanderEist Jun. 1979 37 p refs
(CSIR-ME-1619; ISBN-0-7988-1463-2) Avail: NTIS HC A03/MF A01

A general analysis of the aerodynamics of wind power turbines of the axial flow type is presented. The design parameters appear in nondimensional form and are presented graphically. The theory is applicable to any type of wind power generator, including slow running windmills normally used for powering water pumps as well as fast running machines which are suitable for the generation of electric power. Author

N80-23782# Delta Electronic Control Corp., Irvine, Calif.
DESIGN, CONSTRUCTION AND TESTING OF A 60 kW SOLAR ARRAY AND POWER CONVERSION SYSTEM Final Report, Jan. 1978 - Aug. 1979
J. S. Suelzle Aug. 1979 138 p
(Contract DAAK70-78-C-0018)
(AD-A080877; DECC-61211-003) Avail: NTIS HC A07/MF A01 CSCL 10/1

A 60 kW photovoltaic array and power conversion system was designed, constructed, tested and installed by Delta Electronic Control Corporation. The system is currently operative, augmenting a remote diesel power generating station at Mt. Laguna Air Force Station. The system, which operates without on-site energy storage, operates unattended, extracting the maximum available power from the solar array. GRA

N80-23783# SRI International Corp., Menlo Park, Calif.
NAVAL FACILITY ENERGY CONVERSION PLANTS AS RESOURCE RECOVERY SYSTEM COMPONENTS Interim Report, period ending Oct. 1979
Arlie G. Capps Port Hueneme, Calif. Civil Engineering Lab. Jan. 1980 68 p
(Contract N00123-78-C-0868)
(AD-A081232; CEL-CR-80-002) Avail: NTIS HC A04/MF A01 CSCL 21/4

This interim report addresses concepts for recovering energy from solid waste by using Naval facilities steam plants as principle building blocks of candidate solid waste/resource recovery systems at Navy installations. The major conclusions of this portion of the project are: although it is technically feasible to adapt Navy energy conversion systems to fire Waste Derived Fuels (WDF) in one or more of its forms, the optimal form selected should be a site-specific total system; near- to intermediate-term programs should probably continue to give first consideration to waterwall incinerators and to the cofiring of solid WDF in coal-capable plants; package incinerators and conversions of oil burning plants to fire a fluff form of solid waste fuel may be the options with the greatest potential for the intermediate term because waterwalls would be uneconomical in many small plants and because the majority of medium-sized oil-burning plants will not be converted to burn coal; and pyrolytic processes to produce gaseous and liquid fuels have not been sufficiently developed as yet to be specified for commerical operation. GRA

N80-23784# Air Force Academy, Colo.
LiSi AND LiB AS ANODES IN CHLOROALUMINATE THERMAL BATTERIES
Robert L. Vaughn Jan. 1980 22 p refs
(AF Proj. 2303)
(AD-A081300; FJSRL-TR-80-0002) Avail: NTIS HC A02/MF A01 CSCL 10/3

Lithium silicon (40 weight percent Li) and lithium boron were studied as anode materials in chloroaluminate thermal cells and were compared with lithium aluminum. Lithium boron anodes were tested only at a single temperature (200 C) because of low availability whereas lithium silicon was studied over the temperature range 175 to 275 C. The current density range was 15 to 150 mA/sq cm. The results showed that lithium silicon behaved like lithium aluminum, with linear polarization over the current densities studied. The internal resistances were

the same at all temperatures. On the other hand, lithium boron displayed an activation overpotential at current densities less than 50 mA/sq cm. At higher current densities, an internal resistance of less than 0.19 omega was indicated for the lithium boron-anode cells. This study shows that LiSi offers no advantage over lithium aluminum as an anode for chloroaluminate thermal cells. However, LiB promises to be a superior anode material at high current densities. GRA

N80-23785# California Univ., Berkeley. Lawrence Berkeley Lab. Chemical Biodynamics Div.
PHOTOVOLTAIC PROPERTIES OF METAL-MEROCYANINE-TiO2 SANDWICH CELLS Ph.D. Thesis
T. A. Skotheim Aug. 1979 150 p refs
(Contract W-7405-eng-48)
(LBL-9916) Avail: NTIS HC A07/MF A01

Photocurrent generation in thin films of merocyanine photosensitizing dyes sandwiched between an n-type semiconductor and a metal overlayer was studied using photovoltaic techniques. Titanium dioxide single crystal, doped n-type, was used as the semiconductor and a semitransparent Au film as a metal overlayer. A theoretical model was developed to explain the photovoltaic properties. The model assumes that the principal route for the formation of charge carriers is via singlet excitons diffusing to the merocyanine-TiO2 interface followed by dissociation of the excitons into electron-hole pairs, the electrons being injected into the TiO2 conduction band and the holes into the merocyanine. The model also incorporates field dependence of the quantum efficiency for charge generation and is strongly supported by a variety of steady state and kinetic measurements. DOE

N80-23786# Woodard-Clyde Consultants, San Francisco, Calif. Fossil Fuel and Advanced Systems Div.
ENVIRONMENTAL ASSESSMENT METHODOLOGY: SOLAR POWER PLANT APPLICATIONS. VOLUME 2: INDUSTRIAL IMPLICATIONS AND SECONDARY-IMPACT METHODOLOGY
K. Nair and A. Sicherman Apr. 1979 123 p refs Sponsored by the Elec. Power Res. Inst.
(EPRI Proj. 551)
(EPRI-ER-1070-Vol-2) Avail: NTIS HC A06/MF A01

A methodology for assessing industrial implication and secondary impacts of central solar electric stations was developed using an input output formulation, and a computer model was developed to help estimate these impacts. An independent assessment of the market penetration of solar energy to the year 2000 was made using Bayesian statistical techniques to evaluate different future scenarios. Techniques for assessing the likelihood of these scenarios were also developed. DOE

N80-23787# Georgia Univ., Athens. Dept. of Biochemistry.
MECHANISM OF ENERGY CONVERSION AND TRANSFER IN BIOLUMINESCENCE Final Report
Milton J. Cormier 1979 20 p refs
(Contract EY-76-S-09-0635)
(SRO-635-7) Avail: NTIS HC A02/MF A01

Bioluminescence in the sea pansy, Renilla reniformis, a marine anthozoan coelenterate, is a complex process involving the participation of three proteins specific to anthozoan coelenterate-type systems. These are: (1) the luciferin binding protein, (2) the enzyme luciferase, and (3) the green-fluorescent protein. Each of these were purified and characterized and the structure of luciferin confirmed by synthesis. The Renilla bioluminescence system is the first radiationless energy transfer system the individual components of which have been purified to homogeneity, characterized, and then reassembled in vitro with restoration of the energy transfer function. DOE

N80-23788# Lincoln Lab., Mass. Inst. of Tech., Lexington.
APPLICATION AND DESIGN STUDIES OF COMPRESSED-AIR ENERGY STORAGE FOR SOLAR APPLICATIONS Final Report
G. T. Flynn and J. L. Nash-Webber 28 Sep. 1979 118 p refs
(Contract EX-76-A-01-2295-029)
(CAES-7) Avail: NTIS HC A06/MF A01

Adiabatic compressed air energy storage (CAES), in which both the heat of compression and the compressed air stored separately, was studied. The applicability of this technology to solar power systems was examined. The basic thermodynamics of ideal single and two stage adiabatic CAES is reviewed. Generic single stage and two stage types are discussed, and the efficiency and mass flow rate as a function of storage pressure and stage pressure ratios were investigated. The performance and cost of available turbomachinery for the single and two stage adiabatic systems are examined. DOE

N80-23789# Argonne National Lab., Ill.
OPTIMAL DESIGN OF COMPRESSED AIR ENERGY STORAGE SYSTEMS
F. W. Ahrens, A. Sharma, and K. M. Ragadell 1979 13 p refs Presented at the 6th Annual Conf. on Energy, Rolla, Mo., Oct. 1979 Prepared in cooperation with Illinois Univ., Chicago and Purdue Univ., Lafayette, Ind.
(Contract W-31-109-eng-38)
(CONF-791069-3) Avail: NTIS HC A02/MF A01

Compressed air energy storage (CAES) power systems considered by various electric utilities for load leveling applications are discussed. Models of CAES systems which employ natural underground aquifier formations, and present an optimal design methodology which demonstrates their economic viability are developed. The approach is based upon a decomposition of the CAES plant and utility grid system into three partially-decoupled subsystems. Numerical results are given for a plant employing the Media, Illinois Galesville aquifier formation. DOE

N80-23790# Argonne National Lab., Ill. Office of Program Management Support.
WORLD ENERGY DATA SYSTEM (WENDS). VOLUME 6: INTERNATIONAL AGREEMENT PROFILES
Jun. 1979 202 p
(Contract W-31-109-eng-38)
(ANL-PMS-79-2-Vol-6) Avail: NTIS HC A10/MF A01

The World Energy Data System contains organized data on those countries and international organizations that may have critical impact on world energy. The international agreement profiled in WENDS are all energy related and are organized by energy technology. These are: coal; conservation; fusion; geothermal; nuclear fission; oil, gas, and shale; solar, wind, and ocean thermal; and other (cooperation in electrical power equipment acquisition, energy, energy research, etc.). The agreement profiles are accessible by energy technology and alphabetically by country. DOE

N80-23791# Hittman Associates, Inc., Columbia, Md.
SOLAR APPLICATIONS OF THERMAL ENERGY STORAGE Final Report
C. Lee, L. Taylor, A. J. DeVries, and S. Heibein Jan. 1979 158 p refs
(Contract EM-78-C-01-4275)
(TID-29430) Avail: NTIS HC A08/MF A01

The preparation technology assessment on solar energy systems which use thermal energy storage was studied. The characterization of the current state-of-the-art of thermal energy storage, an assessment of the energy storage needs of solar energy systems, and the synthesis of this information into preliminary design criteria which would from the basis for detailed designs of thermal energy storage are included. Since the goal of the solar thermal energy storage program is to provide optimum storage units for solar thermal energy systems, the focus was on storage concepts that are either commercially available or will be commercially available by 1979. DOE

N80-23792# Department of Energy, Washington, D. C. Office of Energy Technology.
NOAA'S ROLE IN THE SOLAR ENERGY PROGRAM Annual Report, 1978
Aug. 1979 244 p refs
(DOE/ET-0110) Avail: NTIS HC A11/MF A01

The efforts of the National Oceanic and Atmospheric Administration toward monitoring and documenting the USA solar radiation and related weather data are reported. A format to be used for transfer and processing of related solar data sets is presented. Solar radiation maps of the U.S. for total and direct radiation on a monthly and annual basis are presented and

discussed. A section on solar and climatic data applied to subdivisions of the U.S. that are quasi-homogeneous in solar radiation heating demand and topography is included. A listing of the periods of record of all available wind observations in the National Climatic Center's meteorological archives is given. The computational of extra-terrestrial solar radiation, solar evaluation angle, and true solar time of sunrise and sunset is described. Also, research on the effects of aerosols and clouds on solar radiation is described. DOE

N80-23793# Battelle Pacific Northwest Labs., Richland, Wash.
THERMAL ENERGY STORAGE IN AQUIFIERS: PRELIMINARY INFORMATION
R. D. Allen Dec. 1979 86 p refs
(Contract EY-76-C-06-1830)
(PNL-3062) Avail: NTIS HC A05/MF A01

Topics discussed include conceptual design; numerical modelling; field experiments; relevant technical information, feasibility studies; preliminary aquifer selection considerations; and preliminary design and operating considerations. DOE

N80-23794# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
BASIC RESEARCH NEEDS IN ENERGY CONSERVATION
Jack M. Hollander Oct. 1979 28 p refs
(Contract W-7405-eng-48)
(LBL-9939) Avail: NTIS HC A03/MF A01

The role of research in energy conservation, the role of government in conservation research and the role of basic research in conservation are discussed with information on the need for research on the physical, environmental, social, and economic aspects of energy conservation in the residential, industrial, and transportation sectors, and the outlook for U.S. energy supply and demand. DOE

N80-23795# Los Alamos Scientific Lab., N. Mex.
THERMAL FRACTURE EFFECTS IN GEOTHERMAL ENERGY EXTRACTION
Ruth B. Demuth and Francis H. Harlow Nov. 1979 148 p refs
(Contract W-7405-eng-36)
(LA-7963) Avail: NTIS HC A07/MF A01

Heat and water exchange between the primary crack and a lateral thermal fracture are analyzed by means of numerical modeling on a high-speed computer. Three dimensional heat flow in the rock is coupled to a two dimensional approximation for the time-varying convective patterns that result from both forced flow and buoyancy. The physical and mathematical bases for the study are described together with the numerical technique for solution. Three versions of the computer code are listed and some results of representative calculations are included. DOE

N80-23796# United Technologies Research Center, East Hartford, Conn.
PARAMETRIC PERFORMANCE EVALUATION AND TECHNICAL ASSESSMENT OF ADIABATIC COMPRESSED AIR ENERGY STORAGE SYSTEMS Final Report
R. D. Lessard and W. A. Blecher Oct. 1979 157 p refs Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 1199-1)
(EPRI-EM-1188) Avail: NTIS HC A08/MF A01

An adiabatic compressed air energy storage (ACAES) system, an advanced compressed air energy storage system concept which features thermal energy storage (TES) is discussed. The intermediate pressure hybrid ACAES system (an ACAES system wherein the heat of compression is transferred to the TES at a pressure level substantially below the cavern air storage pressure and which utilizes combustion of some fossil fuel prior to expansion to raise the turbine inlet temperature) was examined for near term commercialization. The level of performance and the level of turbomachinery technology required of an intermediate-pressure hybrid ACAES system are evaluated. DOE

N80-23797# Sandia Labs., Livermore, Calif. Energy Systems Study Div.
FIXED SITE HYDROGEN STORAGE. 1: APPLICATIONS IMPACT
J. J. Iannucci and S. L. Robinson 1979 11 p refs Presented at the 2nd Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10 Dec. 1979
(Contract EY-76-C-04-0789)
(SAND-79-8647; CONF-791204-10) Avail: NTIS HC A02/MF A01

The potential applications and requirements for fixed site storage in a scenario of wide spread hydrogen use are examined and quantified. An envisioned hydrogen production/distribution/end-use cycle is scrutinized to identify the storage needs for both continuous and intermittent sources including solar. The most pressing need for storage is found to be at the distribution point, in concurrence with current natural gas practice. Caverns and similar underground storage techniques are shown to be the most promising modes due to their low cost relative to all other options examined. Since a large volume of natural gas storage is presently in service, a pressing need to develop fixed site hydrogen storage technology (beyond the conversion of this underground storage to hydrogen) has not been identified. DOE

N80-23798# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR ENERGY PROGRAM EVALUATION: AN INTRODUCTION
Peter deLeon Sep. 1979 112 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-51-294) Avail: NTIS HC A06/MF A01

An overview of the practice and methodology of program evaluation is presented which defines more precisely the evaluation techniques and methodologies that are the most appropiate to government organizations which are actively involved in the research, development, and commercialization of solar energy systems. There are four basic types of evalution designs: the pre-experimental design; the quasi-experimental design based of time series; the quasi-experimental design based on comparision groups; and the true experimental design. DOE

N80-23799# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
CONVERSION SYSTEM OVERVIEW ASSESSMENT. VOLUME 2: SOLAR-WIND HYBRID SYSTEMS
T. S. Jayadev, J. Henderson, and C. Bingham Aug. 1979 34 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-35-078-Vol-2) Avail: NTIS HC A03/MF A01

Solar-wind hybrid systems are discussed. It is shown that there are large areas in the United States where solar and wind resources are comparable in magnitude and there are diurnal and seasonal complementarities which offer the potential for cost-effective hybrid systems. There are also distinct engineering features of the two conversion technologies. Electric power generation from wind is straightforward and cost-effective, whereas solar thermal conversion to generate heat is more cost-effective than to generate electricity. Examples of hybrid systems utilizing these features on total energy application are presented. DOE

N80-23800# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
DEVELOPMENT OF A SOLAR THERMAL RECEIVER FOR HIGH TEMPERATURE APPLICATIONS
M. Bohn and G. Bessler Nov. 1979 7 p refs Presented at the Semiann. Conf. for Adv. Solar Thermal Tech., Phoenix, Ariz., 11 Dec. 1979
(Contract EG-77-C-02-4042)
(SERI/TP-333-485; CONF-791221-1) Avail: NTIS HC A02/MF A01

A thermal receiver for point focus collectors is described. The receiver uses as a buffer between the cavity surface and the heat transfer fluid a thermal mass, which with a very small temperature drop penalty smooths the flux distribution to eliminate hot spots. The design of the receiver enables significant spillage flux at the receiver to be used. Thus, lower quality optics can be employed in applications not requiring very high temperatures. Design and construction features of the receiver are presented and the testing program is described. DOE

N80-23801# Los Alamos Scientific Lab., N. Mex.
ENERGY STORAGE TECHNOLOGY-ENVIRONMENTAL

IMPLICATIONS OF LARGE SCALE UTILIZATION

M. C. Krupka, J. E. Moore, W. E. Keller, G. A. Baca (Los Alamos Tech. Assoc., Inc., N. Mex.), R. I. Brasier (Los Alamos Tech. Assoc., Inc., N. Mex.), and W. S. Bennett (Los Alamos Tech. Assoc., Inc., N. Mex.) 1979 20 p refs Presented at the 2d Intern. Alternative Energy Sources Conf., Miami Beach, Fla., 10-13 Dec. 1979

(Contract W-7405-eng-36)

(LA-UR-79-3098; CONF-791204-4) Avail: NTIS HC A02/MF A01

Environmental impacts for several energy storage technologies have been identified. State-of-the-art control technology options were similarly identified. Recommendations for research and development on new control technology were made where present controls were either deemed inadequate or non-existent. Specifically, the energy storage technologies under study included: advanced lead-acid battery, compressed air, underground pumped hydroelectric, flywheel, superconducting magnet and various thermal systems (sensible, latent heat and reversible chemical reaction). In addition, a preliminary study was conducted on fuel cell technology. Although not strictly classified as an energy storage system, fuel cells in conjunction with product recycling units can serve an energy storage function. A very large number of potential environmental impacts can be identified for all of these technologies. However, not all are of primary importance. Detailed discussions of a number of environmental impacts from the latest LASL study as they relate to primarily operational situations are emphasized. In addition, a brief discussion on new application for energy storage technologies and the additional costs of controls to be used for mitigation of specific impacts are also presented. DOE

N80-23802# Los Alamos Scientific Lab., N. Mex.

ENERGY FROM HOT DRY ROCK

Robert H. Hendron 1979 22 p refs Presented at the Conf. on Long-Term Energy Resources, 3 Dec. 1979; sponsored by UNITAR

(Contract W-7405-eng-36)

(LA-UR-79-3256; CONF-791216-1) Avail: NTIS HC A02/MF A01

The Hot Dry Rock Geothermal Energy Program is described. The system, operation, results, development program, environmental implications, resource, economics, and future plans are discussed. DOE

N80-23803# New Zealand Energy Research and Development Committee, Auckland.

ELECTRICITY FROM REFUSE

M. White 1979 51 p refs

(NZERDC-44; ISSN-0110-1692) Avail: NTIS HC A04/MF A01

The conversion of refuse to electricity for Auckland involves the combustion of refuse directly or as a refuse-derived fuel to release heat energy, which in turn is converted to high-pressure steam for driving steam turbogenerators. Domestic/commercial collected refuse, privately deposited domestic refuse and industrial/commercial refuse are used. Only those technologies are considered that have been basically proven by commercial operation and systems designed to make use, whenever possible, of existing plant and equipment. The following options are examined for close technical and economic assessment: mass burning in sloping grate boiler plant, semi-suspension combustion boiler plant, supplementary firing of a refuse-derived fuel and refuse-fueled power station using semi-suspension combustion boiler plant. Extensive data are compiled on: refuse from the Auckland urban area; design of systems; environmental and technical aspects. DOE

N80-23804# Los Alamos Scientific Lab., N. Mex.

USE OF ADAPTIVE OPTIMAL CONTROL TO PROVIDE ENERGY CONSERVATION IN LARGE BUILDINGS

Donald R. Farris and Dennis E. Miller (Johnson Controls, Inc., Milwaukee, Wis.) 1979 9 p refs Presented at 18th IEEE Conf. on Decision and Control, Fort Lauderdale, Fla., 12 Dec. 1979

(Contract W-7405-eng-36)

(LA-UR-79-3354; CONF-791227-1) Avail: NTIS HC A02/MF A01

The use of an adaptive linear regulator approach for controlling heating, ventilating, and air conditioning systems in large buildings is discussed. The control manifestations of this approach are compared with those found in conventional applications. The salient features of the approach are discussed, and simulation results are presented. Implementation is discussed, and economic estimates for commercial use of this approach also presented. DOE

N80-23805# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.

PROPOSITION ON ENERGY ANALYSIS AND ECONOMIC EFFICIENCY

Donald I. Hertzmark Oct. 1979 22 p refs

(Contract EG-77-C-01-4042)

(SERI/RR-51-332) Avail: NTIS HC A02/MF A01

Analytical results of an attempt to simultaneously optimize economic and thermodynamic efficiency are presented and discussed. The attempt to impose complete mathematical rationality and consistency on the pricing of energy commodities failed since it was not possible to consistently weigh purely physical efficiency measures, much less social factors. Nevertheless, the use of both material balance and entropy analysis is valuable for evaluating nonmarket decisions, as well as identifying opportunities for process improvements. DOE

N80-23806# Sandia Labs., Livermore, Calif.

HELIOSTAT DESIGN COST/PERFORMANCE TRADEOFFS

Miriam J. Fish and T. A. Dellin Nov. 1979 50 p refs

(Contracts EY-76-C-04-0789; DE-AC04-76DP-00789)

(SAND-79-8248) Avail: NTIS HC A03/MF A01

The heliostat field comprises the most expensive subsystem of a solar central receiver power plant. Cost reductions might be achieved by either total heliostat redesign or component substitution in existing design. The value of changing any of several design specifications, in the current baseline glass/metal heliostat is discussed. Results are quantified in terms of the breakeven cost; i.e., the cost of a new design which will yield the same total system energy cost as the baseline system. Changes in mirror reflectivity, pointing accuracy, surface quality, canting and focusing strategy, heliostat size, and stow requirements were evaluated. DOE

N80-23807# Los Alamos Scientific Lab., N. Mex.

RESIDENTIAL PASSIVE SOLAR SYSTEMS: REGIONAL SENSITIVITY TO SYSTEM PERFORMANCE COSTS, AND ALTERNATIVE PRICES

C. Kirschner, S. Ben-David, and F. Roach 1979 32 p Presented at the 2nd Miami Intern. Conf. on Alternatives Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979

(Contract W-7405-eng-36)

(LA-UR-79-3390; CONF-791204-12) Avail: NTIS HC A03/MF A01

The economic potential of two passive space heating configurations were analyzed. These were a masonary thermal storage wall (trombe) and a direct gain system - both with night insulation. A standard tract home design for each of the two passive systems was used throughout the analysis to allow interregional comparisons. The economic performance of these two systems was evaluated on a regional basis (223 locations) throughout the United States. A sensitive analysis was conducted on two conventional energy types (electricity and natural gas) to determine the impact of alternative fuel price escalation rates and solar costs upon feasibility of the two solar systems. Cost goals for solar system prices were established under one set of future fuel prices and stated economic conditions. DOE

N80-23808# Dow Chemical Co., Midland, Mich. Process Development Dept.

ENERGY FROM IN SITU PROCESSING OF ANTRIM OIL SHADE Quarterly Technical Progress Report, Apr. - Jun. 1979

Lawrence J. Washington 20 Jul. 1979 43 p ref

(Contract EX-76-C-01-2346)

(FE-2346-49) Avail: NTIS HC A03/MF A01

Four wells were drilled and cored in the 100 series for use in evaluating the fracturing in Wells No. 101-106 and for possible use in subsequent extraction trails. Extensive logging, liquid

permeability, air permeability and well communication tests were carried out for fracture assessment at both the hydraulic/explosive fracture site and the explosive underream site. Although these evaluations are still incomplete and no decision can yet be made as to which would be preferred for an extraction trail, both site have much greater permeability and better interwell communications than was present in the first extraction trails on the existing site. DOE

N80-23809# Schumacher and Associates, Inc., Sacramento, Calif.
PRELIMINARY DESIGN REPORT: NEW IDEAS FOR HELIOSTAT REFLECTOR CLEANING SYSTEMS
J. Schumacher, J. Hansen, and J. Nevenzel Dec. 1979 135 p refs Prepared for Sandia Labs., Albuquerque
(Contract EY-76-C-04-0789)
(SAND-79-8181) Avail: NTIS HC A07/MF A01

The feasibility of two concepts for cleaning heliostat reflectors are investigated and the results are itemized. In addition, the design and construction of a reflectometer and wind tunnel, and the performance of some dust accumulation studies are also discussed. DOE

N80-23810# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
METAL FOILS FOR DIRECT APPLICATION OF ABSORBER COATINGS ON SOLAR COLLECTORS
Carl M. Lampert Aug. 1979 19 p refs Presented at the 2nd Am. Electroplaters Soc. Symp. on Coatings for Solar Collectors, St. Louis, 16-17 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9324-Rev; CONF-791021-1-Rev) Avail: NTIS HC A02/MF A01

The basic materials and processing associated with the production of coated metal foils for solar collector absorber surfaces are discussed. Also covered are details of heavier metal strips for direct fabrication of solar collectors. Techniques including bonding methods and the use of adhesive are surveyed. Commercial solar foil manufacturers are covered along with the research efforts in this area. In conclusion, advantages and disadvantages are outlined, with specific recommendations. DOE

N80-23811# Monsanto Research Corp., Dayton, Ohio.
LOW-COST MIRROR CONCENTRATOR BASED ON DOUBLE-WALLED METALLIZED, TUBULAR FILMS Semiannual Technical Progress Report, 20 Aug. 1978 - 19 Feb. 1979
J. W. Leffingwell, G. L. Ball, III, J. L. Schuendeman, and T. A. Orofino 30 Mar. 1979 44 p refs
(Contract EM-78-C-04-4227)
(ALO-4227-12; SAPR-2) Avail: NTIS HC A03/MF A01

The development of a potentially, low cost, air inflatable, tubular plastic, nontracking 3X solar collector is described. The design employs joined truncated cylindrical sections which reduce both cover and mirror material requirements by 40% compared with a conventional cylindrical design. Aluminum foil-plastic laminates were selected as an alternative to aluminized polyester films because of their low cost, ease of fabrication, good durability, high strength, and acceptable reflectivity. Specially UV-stabilized and polyester scrim reinforced flexible polyvinyl chloride film was selected for use as the outer transparent cover material because of its mechanical and optical durability, acceptable transmission characteristics and its potential low cost. DOE

N80-23812# Foster Wheeler Corp., Livingston, N.J.
SOLAR PRODUCTION OF INDUSTRIAL PROCESS STEAM RANGING IN TEMPERATURE FROM 300 DEG F TO 550 DEG F, PHASE 1. VOLUME 3: APPENDICES (CONT) Final Report, 30 Sep. - 30 Jun. 1979
30 Jun. 1979 243 p refs
(Contract ET-78-C-03-2199)
(DOE/CS-32199-3) Avail: NTIS HC A11/MF A01

The following appendices are included: (1) instruments, (2) electrical specifications, (3) protective coverings, (4) welding requirements, (5) engineering specifications, and (6) administrative. DOE

N80-23813# Foster Wheeler Corp., Livingston, N.J.
SOLAR PRODUCTION OF INDUSTRIAL PROCESS STEAM RANGING IN TEMPERATURE FROM 300 DEGREES F TO 550 DEGREES F, PHASE 1. VOLUME 2: APPENDICES Final Report
30 Jun. 1979 232 p
(Contract ET-78-C-03-2199)
(DOE/CS-32199-2) Avail: NTIS HC A11/MF A01

The following appendices are presented: (1) equipment requisitions, (2) instrument list, (3) mechanical subcontract requisition, (4) electrical subcontract requisition, (5) site preparation and subcontract requisition, (6) building subcontract requisition, and (7) job specifications. DOE

N80-23814# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
SOLAR THERMAL REPOWERING UTILITY VALUE ANALYSIS Final Report
Roger Taylor, John Day (Westinghouse Electric Corp., Pittsburgh), Brian Reed (Westinghouse Electric Corp., Pittsburgh), and Mike Malone (Westinghouse Electric Corp., Pittsburgh) Dec. 1979 225 p refs
(Contract EG-77-C-01-4042)
(SERI/TR-8016-1) Avail: NTIS HC A10/MF A01

The value of a retrofitting central receiver energy supply systems to existing steam-electric generating stations (repowering) is assessed. The modeling tools and assumption used are described and the results are presented and interpreted. DOE

N80-23815# Alabama Univ., Huntsville. Environmental and Energy Center.
DATA HANDBOOK FOR THE NATIONAL SOLAR ENERGY DEMONSTRATION PROGRAM
David L. Christensen May 1979 97 p
(Contract EM-78-S-01-5216)
(DSE/5216-T3) Avail: NTIS HC A05/MF A01

Information is presented in a matrix format listing the technical and programmatic data concerning the various project sites selected for the National Solar Energy Demonstration Program. It incorporates the commercial, residential, and other demonstration projects which are now a part of the national program. DOE

N80-23816# Mega Analytical Research Services, Inc., Silver Spring, Md. Mega Engineering Div.
STUDY AND ANALYSIS OF A LOW COST CEMENT BONDED FLAT PLATE SOLAR COLLECTOR Final Report
Jan. 1979 136 p refs
(Contract EG-77-04-4122)
(ALO-4122-T1) Avail: NTIS HC A07/MF A01

A flat plate collector was designed and tested using low cost materials. This collector absorber plate included copper circulating tubes bonded to a flat sheet of conductive material using high service temperature, low outgassing, high conductivity adhesives. A series of candidate adhesive were evaluated. Structural and thermal tests were performed using galvanized sheet steel collector plates and aluminum collector plates with copper tubes to determine the conductivity of bond joints. The structural integrity of bond joints was evaluated under relative thermal expansion forces at various temperatures (ranging from 35 C to 300 C). Thermal cycling tests were conducted to evaluate fatigue of bond joints and to evaluate the degradation of thermal conductivity of these bond joints. A cost/performance summary was made (using F-chart) to determine the potential cost sevings realized compared with conventional systems. DOE

N80-23817# Monsanto Research Corp., Dayton, Ohio.
NON-CONCENTRATING COLLECTORS FOR SOLAR HEATING APPLICATIONS (MEDIUM TEMPERATURE AIR HEATERS BASED ON DURABLE TRANSPARENT FILMS) Final Report, 30 Sep. 1977 - 31 Oct. 1978
J. W. Leffingwell, J. L. Schwendeman, G. L. Ball, and T. A. Orofino Mar. 1979 143 p refs
(Contract EG-77-C-04-4147)
(ALO-4147-T1; MRC-DA-867) Avail: NTIS HC A07/MF A01

A special UV-stablized and scrim-reinforced flexible photovoltaic conversion film was developed, characterized, and tested on an air solar heater. Solar energy transmission of early

precontract 20/mil thick film was determined to be about 83% after two months outdoor Florida exposure, dropping to 78% after two years. Outdoor exposure and artificial UV aging tests indicate that a 10 year lifetime could be possible. The fabricated solar heater had a lower efficiency than predicted from computer modeling (43% for 129 F output with 62 F temperature rise at an ambient temperature of 60 F) suggesting design problems which could most easily be overcome by changing from a double-glazed non-selective absorber collector to a single-glazed-selective absorber heater. DOE

N80-23818*# Thermo Electron Corp., Waltham, Mass.
DOE/JPL ADVANCED THERMIONIC TECHNOLOGY PROGRAM Progress Report, Apr. - Jun. 1979
1979 73 p refs
(Contracts JPL-95509; EY-76-C-02-3056)
(NASA-CR-163134; COO-3056-41; PR-39) Avail: NTIS HC A04/MF A01 CSCL 10A

Progress made in different tasks of the advanced thermionic technology program is described. The tasks include surface and plasma investigations (surface characterization, spectroscopic plasma experiments, and converter theory); low temperature converter development (tungsten emitter, tungsten oxide collector and tungsten emitter, nickel collector); component hardware development (hot shell development); flame-fired silicon carbide converters; high temperature and advanced converter studies; postoperational diagnostics; and correlation of design interfaces. DOE

N80-23819# Sandia Labs., Albuquerque, N. Mex.
NON-INVERTING HELIOSTAT STUDY
J. B. Blackmon Jul. 1979 101 p refs Prepared in cooperation with McDonnell-Douglas Corp.
(Contract EY-76-C-04-0789)
(SAND-78-8190; MDC-G7876) Avail: NTIS HC A06/MF A01

Implications of employing a non-inverting heliostat design with a lower capital cost relative to an inverting design are considered from three standpoints: (1) effects of dust buildup, corresponding cleaning frequencies, and resultant cleaning costs; (2) effects of hail impact; and (3) reflected beam safety issues. It is concluded that elimination of the inverting stow hardware and addition of reflector provides a direct subsystem cost savings. DOE

N80-23820# Los Alamos Scientific Lab., N. Mex.
PRELIMINARY DEFINITION AND CHARACTERIZATIONS OF SOLAR INDUSTRIAL PROCESS HEAT TECHNOLOGY AND MANUFACTURING PLANT FOR THE YEAR 2000
Richard T. Meyer and Ted Prythero 1979 7 p Presented at the Solar Ind. Process Heat Conf., Oakland, Calif., 31 Oct. - 2 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2812; CONF-791024-4) Avail: NTIS HC A02/MF A01

The findings and projections of this preliminary definition and characterization of a solar industrial process heat technology and manufacturing plant for the year 2000 indicate that the technology and the manufacturing would be significantly more sophisticated and expanded than exists in the solar industry today. The solar process heat technology is defined to be a parabolic trough collector system and to utilize a combustion of the more advanced materials and components under current development. The manufacturing operations are projected to include glass-making, silvering, electroplating and plastic-forming, which, while standard industrial procedures, will be additions to or expansions of existing solar manufacturing plants. These integrated operations for the year 2000 solar facility will introduce important environmental residuals which will need to be managed and controlled to satisfy local, state, and federal environmental standards. DOE

N80-23821# Oak Ridge National Lab., Tenn. Engineering Technology Div.
SUMMARY OF THE RESEARCH AND DEVELOPMENT EFFORT ON OPEN-CYCLE COAL-FIRED GAS TURBINES
M. E. Lackey Oct. 1979 126 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6253) HC A07/MF A01

Extensive experience gained with gas turbines operating not only with coal as fuel but also with dusty inlet air and with dirty fuels (such as heavy oils and blast furnace gas) as well as petroleum catalytic cracking units was reviewed. All this experience indicates that the particulate content of the hot gases fed to the turbine must be kept to less than approximately 1 ppM to keep turbine bucket erosion to an acceptable level for turbine inlet temperatures of 1500 F or more. It is shown that cyclone separators can be used to reduce the particulate content to as low as 100 ppM under the best conditions. The only effective was found to reduce the particulate content of blast furnace gas and gas from coal gasification units to the 1 ppM required for a high temperature gas turbines is to cool the gas and pass it through a two-stage water scrubber or equivalent before burning it. DOE

N80-23822# California Univ., Livermore. Lawrence Livermore Lab.
APPLICATION OF SHALLOW SOLAR PONDS FOR INDUSTRIAL PROCESS HEAT: CASE HISTORIES
Alan B. Casamajor 4 May 1979 13 p refs Presented at the Intern. Solar Energy Soc., Atlanta, 28 May - 1 Jun. 1979 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-82367; CONF-790541-57) Avail: NTIS HC A02/MF A01

The shallow solar pond collector system is approaching commercialization. Three prototype or demonstration projects, Sohio Petroleum Company, Sweet Sue Kitchens, and Fort Benning, are described. A critique of each project points out the significant factors that affect the individual projects and shallow-solar pond technology in general. Particular attention is drawn to problems encountered and solutions proposed. Finally, possible marketing organization and strategies are discussed. DOE

N80-23823# Battelle Pacific Northwest Labs., Richland, Wash.
NUMERICAL ANALYSIS OF TEMPERATURE AND FLOW EFFECTS IN A DRY, TWO-DIMENSIONAL, POROUS-MEDIA RESERVOIR USED FOR COMPRESSED AIR ENERGY STORAGE
L. E. Wiles Oct. 1979 87 p refs
(Contract EY-76-C-06-1830)
(PNL-3047) Avail: NTIS HC A05/MF A01

The hydrodynamics and thermodynamic responses of a compressed air energy storage dry porous media reservoir subjected to simulated air mass cycling were investigated to develop design guidelines for the efficient and stable operation of the air storage reservoir. The analysis and results obtained by two dimensional modeling of dry reservoirs are presented. While the fluid/thermal response of the underground system is dependent on many parameters, the two-dimensional model was applied only to those parameters that entered the analysis by virtue of inclusion of the vertical dimension. In particular, the parameters or responses that were quantified or characterized include well bore heat transfer, heat losses to the vertical boundaries of the porous zone, gravitationally induced flows, producing length of the wellbore, and the effects of nonuniform permeability. The analysis of the wellbore heat tranfer included consideration of insulation, preheating (bubble development with heated air), and air mass flow rate. DOE

N80-23824# Mechanical Technology, Inc., Latham, N. Y.
APPLICATION OF MAGNETIC SUSPENSIONS AND FLUID FILM BEARINGS TO ENERGY STORAGE FLYWHEELS
M. Eusepi, L. Martin, and A. Ray Mar. 1979 168 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7007) Avail: NTIS HC A08/MF A01

The design of a suspension system for the support of a 10 kWh energy storage flywheel, with scaling equations and curves suitable for extending the 10 kWh design to other flywheel sizes up to 100 kWh is presented. The design of a test vehicle suitable for evaluating the final suspension design is included. The first phase of this effort was a concept study in which fluid film bearings for both radial and axial load support and magnet suspensions were examined in several combinations to determine suitability. The concept study is described and includes discussions on flywheel sizing, journal and thrust bearing sizing, magnetic suspension sizing and geometric arrangements. DOE

N80-23825# Sandia Labs., Livermore, Calif. Solar Components Div.
THERMOCHEMICAL ENERGY STORAGE AND TRANSPORT PROGRAM Progress Report, Oct. 1977 - Dec. 1978
T. T. Bramlette Sep. 1979 109 p refs
(Contract EY-76-C-04-0789)
(SAND-79-8208) Avail: NTIS HC A06/MF A01

To exploit the potential advantages and quantify the disadvantages of thermochemical reactions for energy storage and transport applications, the program was structured initially to explore a wide range of chemical reactions and applications. In general, the development procedure consists of: (1) identification and evaluation of preferred current and future users of reversible chemical reactions for energy storage and transport; (2) identification of specification requirements and evaluation of available technology and technology needs for selected storage and transport systems; (3) formulation and evaluation of energy storage and transport concepts which meet the requirements established above; (4) definition and development of the required technology; (5) comparison of thermochemical storage and transport concept with competing technologies, and assessment of their conservation potential; and (6) development of the most promising concepts and systems to the point of demonstration on a scale commensurate with commercial applications. Progress made during the reporting period is summarized. DOE

N80-23826# Northeast Solar Energy Center, Cambridge, Mass.
STATUS OF INSOLATION RESOURCE ASSESSMENT IN THE NORTHEAST
Susan L. Kannenberg Dec. 1979 35 p refs
(Contract EM-78-C-01-4274)
(NESEC-6) Avail: NTIS HC A03/MF A01

The status of insolation resource assessment is described. Activities performed, services offered, and general features of solar radiation which are significant to the application of solar energy in the Northeast are summarized. DOE

N80-23827# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.
OFF-PEAK ELECTRIC AUXILIARY HEAT FOR SOLAR AIR-HEATING SYSTEMS Final Report, 1 Jun. 1977 - 31 Dec. 1978
Thomas B. Jones and Paul J. Wilbur Jan. 1979 51 p refs
(Contract EG-77-S-02-4516)
(COO-4516-1) Avail: NTIS HC A04/MF A01

The performance of various solar auxiliary heating system options was examined by means of computer simulation. A storage reservoir which is separate from the solar reservoir was found to be preferable. Performance was generally not found to be sensitive to the time at which off-peak energy is available. Control schemes that predict energy requirements for a forthcoming on-peak period and account for energy in solar storage are preferable and a reservoir heater that can be staged so heating can be accomplished over the full duration of the on-peak period to supply different levels of energy is desirable. The system installed in a solar house for testing is described. DOE

N80-23828# Oak Ridge National Lab., Tenn.
FOSSIL ENERGY PROGRAM Progress Report, Oct. 1979
L. E. McNeese Dec. 1979 79 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7144) Avail: NTIS HC A05/MF A01

The utilization of coal and other fossil fuel alternatives to oil and gas as sources of clean energy is addressed. Coal conversion development, materials engineering, a coal equipment test program, an atmospheric fluid bed combustor for cogeneration, engineering studies and technical support, process and program analysis, environmental assessment studies, magnetic beneficiation of dry pulverized coal, technical support to a fluid bed combustion program, coal cogeneration/district heating plant assessment, chemical research and development, and technical support to major liquefaction projects are specifically discussed. DOE

N80-23829# Teledyne Energy Systems, Timonium, Md.
SELENIDE ISOTOPE GENERATOR FOR THE GALILEO MISSION: COPPER/WATER AXIALLY-GROOVED HEAT PIPE TOPICAL REPORT
N. P. Strazza 30 Jun. 1979 136 p refs
(Contracts ET-78-C-01-2865; DE-AC01-78ET-33009)
(TES-33009-44) Avail: NTIS HC A07/MF A01

A summary of the major accomplishments for the development, fabrication, and testing of axially-grooved copper/water heat pipes for selenide isotopic generator (SIG) applications is presented. The early development consisted of chemical, physical, and analytical studies to define an axially-grooved tube geometry that could be successfully fabricated to provide the desired long term (up to seven years) performance. Heat pipe fabrication procedures, measured performance and accelerated life testing of heat pipes S/Ns AL-5 and LT-57 are discussed. DOE

N80-23830# Systems Consultants, Inc., Washington, D. C.
REGIONAL APPLICATION OF FOSSIL ENERGY TECHNOLOGIES: AN ANALYTICAL APPROACH Final Report
W. Rebello, D. Canete, H. Phipps, and R. Smith Sep. 1979 312 p refs
(Contract EX-76-C-01-2442)
(DOE/ET-2442-1) Avail: NTIS HC A14/MF A01

Energy supply/demand profiles are presented for the 50 states and the nine US census regions using 1974 statistics. These profiles include quality and type of energy reserves, annual primary resource production, and consumption by end-use sector. A method for use by energy planners in assessing the effects of policy decision on energy profiles was developed. A series of energy indices was derived for each census region. The indices are defined to include the effect of consumption of relatively scarce fuels (oil and gas) versus plentiful fuels (coal). A number of fossil energy technologies under development are described. The potential impact of the maturation of these technologies on each census region's energy posture is discussed in conjunction with any regional constraints that may exist. Finally, a number of sample what if scenarios are discussed and the impact of fossil fuel replacements on national, regional, and sector energy consumption quantitatively is assessed. DOE

N80-23831# Rockwell International Corp., Golden, Colo. Energy Systems Group.
MILLVILLE WIND TURBINE GENERATOR: FAILURE ANALYSIS AND CORRECTIVE DESIGN MODIFICATION
C. A. Waldon, M. J. Carr, and V. K. Grotzky Jul. 1979 25 p refs
(Contract EY-76-C-04-3533)
(RFP-2992/3533/79-3) Avail: NTIS HC A02/MF A01

Fatigue cracks in the blade skins of the Millville Wind Turbine Generator were fractographically analyzed. It is believed they were caused by large flapwise deflections during a wind storm on December 4, 1978. The deflections caused the skin to buckle, which initiated rapidly growing fatigue cracks. Propagation continued to the leading edge, moving radially inward and outward along the leading edge radius. A modified blade design which incorporates several corrective techniques was then developed. DOE

N80-23832# Oak Ridge Y-12 Plant, Tenn. Fabrication Systems Dept.
OAK RIDGE FLYWHEEL EVALUATION LABORATORY Annual Report, 1 Apr. - 30 Sep. 1979
R. S. Steele, Jr., J. M. Casstevens, and B. J. Sutton Dec. 1979 29 p refs
(Contracts W-7405-eng-48; W-7405-eng-26)
(Y-2210) Avail: NTIS HC A03/MF A01

The Oak Ridge Flywheel Evaluation Laboratory (ORFEL) was assembled, and the initial stages of proof testing were completed. The significant accomplishments for the past year included the establishment of adequate full-time personnel; facility modification to reflect the emphasis on flywheel evaluation over simple testing; and the facility proof test involving two aluminum disk flywheels and one composite flywheel. DOE

N80-23833# IBM Federal Systems Div., Huntsville, Ala.
ENVIRONMENTAL DATA FOR SITES IN THE NATIONAL SOLAR DATA NETWORK
May 1979 266 p
(Contract EG-77-C-01-4049)
(Solar/0010-79/05) Avail: NTIS HC A12/MF A01

A major goal of the National Solar Heating and Cooling Demonstration Program is to collect and analyze data which will be used to determine the thermal performance of selected solar energy systems. To meet the goals and objectives of the Demonstration Program, the National Solar Data Network was developed. The network consists of sensors which measure key performance parameters at a selected site, a site data acquisition system, telephone transmission circuits and a central data processing system which collects data and performs the computations required for system performance analysis. The output of the National Solar Data Network is a monthly performance report which defines the energy contribution of the solar energy system and resultant fossil fuel savings. The performance data for homes throughout the US is included. DOE

N80-23834# Hughes Research Labs., Malibu, Calif.
PHOTOVOLTAIC MECHANISMS IN POLYCRYSTALLINE THINS-FILM SOLAR CELLS Quarterly Progress Report, 27 Sep. - 27 Dec. 1978
K. Zanio Jun. 1979 26 p refs
(Contract ET-78-C-01-3412)
(DSE/3412-T1; QPR-1) Avail: NTIS HC A03/MF A01

Preliminary studies were initiated to examine and alleviate the deleterious effect of grain boundaries in solar cells fabricated from InP. The planar reactive deposition system was modified so that the InP substrate temperature could be reduced below the single crystalline to polycrystalline transition temperature and effects of grain boundaries on p-n junctions can be more readily and reproducibly separated out. A model for grain boundaries intersecting a p-n junction was introduced. In the model, the grain boundary is treated as a two dimensional array of lower bandgap material which enhances the leakage current at the p-n junction. The effect of various etchants on grain boundaries in InP was also examined as a preliminary step toward passivating the grain boundaries. An anodic oxide and InGaP, both candidates as passivation layers, were deposited on single-crystal InP. DOE

N80-23835# Fluidyne Engineering Corp., Minneapolis, Minn.
MHD AIR HEATER DEVELOPMENT TECHNOLOGY Progress Report, Oct. - Dec. 1978
Apr. 1979 25 p refs
(Contract ET-78-C-01-3005)
(CONS-3005-T2) Avail: NTIS HC A02/MF A01

Work on different tasks of the magnetohydrodynamic air heater development technology is described. The influence of heater system layout, duct dimensions, and heater sequencing on flow distribution was studied. One result was that localizing the bulk of the pressure drop in the heaters tends to minimize heater-to-heater flow differences. An analysis of current flow back up the air duct from the combustor was done. Results showed that the voltage gradient and power loss back up the air duct depend on the ratio of electrical conductivities of air and duct wall insulation. Heat 201 was run with a Corhart X-317 matrix in the rig. Matrix test 7 (Heat 201) ran for over four hundred hours but was terminated early because of a restriction in the bed. This was caused by failure of the insulating lining in the hot gas duct between the burner and the matrix. DOE

N80-23836# CCB/CUMALI Associates, Oakland, Calif.
PASSIVE SOLAR CALCULATION METHODS Interim Report
15 Apr. 1979 70 p refs
(Contract EM-78-C-01-5221)
(DSE/5221-T1) Avail: NTIS HC A04/MF A01

The results accomplished under the following tasks: (1) evaluation of existing passive solar calculation methods, (2) BLAST/DOE-1 program interface and comparison with BR-202, and (3) development of analytic relationships between the thermal balance and weighting factor techniques are detailed. The various methods available for use in thermal load analysis are presented with detailed information on algorithm used in the thermal balance and weighting factor techniques. DOE

N80-23837# Bechtel National, Inc., San Francisco, Calif. Research and Engineering Operation.
DESIGN OF LOW-COST STRUCTURES FOR PHOTOVOLTAIC ARRAYS. VOLUME 2: TECHNICAL STUDIES AND APPENDICES Final Report
Nov. 1979 238 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7002-Vol-2) Avail: NTIS HC A11/MF A01

A study of low cost support structures for flat photovoltaic panels set at a fixed angle to the ground was conducted. The work began with a survey of solar system manufacturers. The results showed a diverse approach to the design of support structures and a lack of systematic design criteria. Therefore, a series of conceptual designs of support structures and their foundations were developed based on the use of concrete, steel or aluminum, and timber. A 6 MWe peak baseline photovoltaic power plant was conceptualized in order to bring a practical perspective to cost estimating for the designs. Detailed civil-structural design criteria were developed. These criteria identified loadings for normal operating conditions and extreme environmental conditions. The study results include detailed designs for eight array support structures and foundations for flat plate arrays using 8 foot wide panels with foundations spaced 20 feet apart along the rows in the east-west direction. Cost estimates for supports and foundations were shown to vary between $2 to $3 per square foot of supported panels (deflated to 1975 dollars). DOE

N80-23838# Department of Energy, Washington, D. C. Office of Fusion Energy.
MAGNETIC FUSION ENERGY AND COMPUTERS: THE ROLE OF COMPUTING IN MAGNETIC FUSION ENERGY RESEARCH AND DEVELOPMENT
Washington, D.C. DOE Oct. 1979 57 p
(DOE/ER-0033) Avail: NTIS HC A04/MF A01

The role of computing in the magnetic confinement fusion program is examined. The present status of the magnetic fusion energy computer center and its associated network is described. The role of computer models in the main elements of the fusion program is also examined and their dependence on the most advanced scientific computer is discussed. A study of computer requirements for the magnetic fusion energy program was conducted and the results of this analysis are presented. DOE

N80-23839# Oak Ridge National Lab., Tenn. Chemistry Div.
MOLTEN CARBONATE FUEL CELL PROGRAM. COMPOSITION GRADIENTS INDUCED BY CURRENT FLOW IN Li_2CO_3-K_2CO_3 MIXTURES Progress Report, 1 Jul. - 31 Dec. 1978
J. Braunstein, H. R. Bronstein, S. Cantor, D. E. Heatherly, J. I. Padova, T. M. Thomas, and C. E. Vallet Dec. 1979 15 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7061) Avail: NTIS HC A02/MF A01

Gradients in the Li/K ratio of a LiKCO3 electrolyte caused by current flow in a molten carbonate fuel cell is the cation mobilities are unequal were examined. Composition gradients were predicted from estimated values of mobility, activity, and diffusivity utilizing a one dimensional model. Predictions from a similar model for a system of known properties were confirmed experimentally by electrolysis-relaxation experiments. The model calculations for carbonates are consistent with electrolysis-relaxation measurements on fuel cell tiles, but clearly indicate the need for additional specific physical property data, especially the tranference number. DOE

N80-23840# Puerto Rico Univ., Rio Piedras. Agricultural Experiment Station.
PRODUCTION OF SUGARCANE AND TROPICAL GRASSES AS A RENEWABLE ENERGY SOURCE Quarterly Report, 1 Dec. 1978 - 28 Feb. 1979
Alex G. Alexander, W. Allison, and M. Garcia 1979 45 p refs
(Contract ET-78-S-05-5912; AES-UPR Proj. C-481)
(ORO-5912-T1; QR-3) Avail: NTIS HC A03/MF A01

Research on candidate screening, water and nitrogen regimes, and ratoon-crop performance for row-spacing, harvest frequency, and varietal variables is discussed. Greenhouse tests revealed several grasses having growth and drouth-tolerance characteristics superior to Sordan 70A, the project's outstanding short-rotation candidate up to this time. Johnson grass (Sorghum halepense), regarded as a weed by farmers, gave very favorable growth performances under simulated arid and semi-arid conditions. At six months into year 2, first ratoon data for sugarcane and

napier grass indicate yield increases of 33% and 4%, respectively, over plant crop yields. The NCo 310 is emerging as the outstanding sugarcane variety tested to date. There are no consistent responses to narrow row spacing. Frequent recutting (at 2 month intervals) is gradually destroying sugarcane but is not appreciably affecting napier grass. DOE

N80-23841# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
FEDERAL REPUBLIC OF GERMANY: ESTIMATES OF FUTURE ENERGY/GDP RELATIONSHIPS
R. Bruce Williamson and Edward L. Allen Dec. 1979 64 p refs
(Contracts EY-76-C-05-0033; DE-AC05-76OR-00033)
(ORAU/IEA(M)-79-22) Avail: NTIS HC A04/MF A01

Postwar trends in the West German economy, demography, and energy use were analyzed. The base year is 1976, and projections are made up to the year 2000 for gross domestic product (GDP) and sectoral energy demand. West Germany's 2.8 percent average annual GDP growth rate for the 1970s contrasts sharply with the 5.4 percent rate achieved in the 1960s. Future GDP growth is projected to level off at 2.9 percent a year, on the average, between now and 2000. This projection places German economic growth below that of Japan, Canada, and France but ahead of that projected for Italy and the United Kingdom. The relationship between West Germany energy demand and economic growth was stable in the postwar period. In 1976, total energy consumption stood at 9.8 quads and is projected to increase to 12.7 quads in 2000, an average annual 1.1 percent increase. The E/GDP ratio is expected to improve substantially by the year 2000, with the residential sector leading the way in energy efficiency. DOE

N80-23842*# General Electric Co., Schenectady, N. Y.
CONCEPTUAL DESIGN OF THERMAL ENERGY STORAGE SYSTEMS FOR NEAR-TERM ELECTRIC UTILITY APPLICATIONS Final Report
E. W. Hall, W. Hausz, R. Anand, N. LaMarche, J. Oplinger, and M. Katzer Nov. 1979 524 p refs Sponsored by NASA and EPRI
(Contract EC-77-A-31-1034; EPRI Proj. 1082-1)
(NASA-CR-159577; EPRI-EM-1218) Avail: NTIS HC A22/MF A01 CSCL 10A

Over forty concepts were examined for storage media, forms of containment, and cycle configurations for conversion to electricity. An extensive analysis and screening process resulted in selecting two coal-fired and two nuclear plants for detail conceptual design. The coal plants utilized peaking turbines and the nuclear plants varied the feedwater extraction to change power output. It was shown that the performance and costs of even the best of these systems could not compete in near-term utility applications with cycling coal plants and typical gas turbines available for peaking power. Lower electricity costs, greater flexibility of operation, and other benefits can be provided by cycling coal plants for greater than 1500 hours of peaking or by gas turbines for less than 1500 hours if oil is available and its cost does not increase significantly. DOE

N80-23843# General Electric Co., Schenectady, N. Y. Materials and Processes Lab.
LAMINATED COMPOSITE DISC FLYWHEEL DEVELOPMENT Interim Report, Jan. - 30 Jun. 1979
R. P. Nimmer, K. A. Torossian, and J. S. Hickey Jul. 1979 75 p refs
(Contract W-7405-eng-48)
(UCRL-15154; IR-2) Avail: NTIS HC A04/MF A01

A flywheel with high energy density potential is considered. The actual testing of fabricated composite discs is reported with emphasis on spin tests to destruction on laminated S2-glass discs of various stacking sequences. The tests were designed to investigate the effect of alpha-number upon flywheel energy density. Progress in testing and interpreting results of these initial laminated disc flywheels is reported. J.M.S.

N80-23844# Argonne National Lab., Ill.
OPEN-CYCLE COAL-FIRED LIQUID-METAL MHD
E. S. Pierson, M. Petrick, F. Schreiner, and D. Cohen 1979 12 p refs Presented at the 18th Symp. on Eng. Aspects of Magnetohydrodyn., Butte, Mont., 18-20 Jun. 1979
(Contract W-31-109-eng-38)
(CONF-790640-7) Avail: NTIS HC A02/MF A01

An open-cycle, coal fired, liquid magnetohydrodynamics (MHD) concept is described and compared with the open-cycle plasma MHD cycle, and it is shown that, in the former, temperatures are much lower and the air preheater and radiant boiler are eliminated. The constraints on the electrodynamic working fluid and the choice of copper are discussed. Recent experiments with liquid copper and coal combustion gas are described, and the indicated implications for environmental impact, i.e., SO/sub x/ and NO/sub x/ control, are discussed. Initial efficiency calculations yield values comparable to those for open-cycle plasma MHD at combustor temperatures as much as 1000 K lower and MHD generator temperatures more than 1000 K lower than is the case for open-cycle plasma MHD. Significantly, the liquid metal MHD system uses components that, except for the generator, are close to or within present-day technology, and it appears that readily available containment materials are compatible with the fluids. DOE

N80-23845# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
VERTICAL AXIS WIND TURBINE DEVELOPMENT: EXECUTIVE SUMMARY Final Report, 1 Mar. 1976 - 30 Jun. 1977
R. E. Walters, J. B. Fanucci, P. W. Hill, and P. G. Migliore Jul. 1979 26 p
(Contract EY-76-C-05-5135)
(ORO-5135-77-5-Summ) Avail: NTIS HC A03/MF A01

Information is presented concerning (1) the numerical solution of the aerodynamics of cross-flow wind turbines; (2) boundary layer considerations for a vertical axis wind turbine (VAWT); (3) VAWT outdoor test model; (4) low solidity blade tests; (5) high solidity blade design; (6) cost analysis of the VAWT test model; (7) structural parametric analysis of VAWT blades; and (8) cost study of current wind energy conversion systems. DOE

N80-23846# West Virginia Univ., Morgantown. Dept. of Aerospace Engineering.
VERTICAL AXIS WIND TURBINE DEVELOPMENT Final Report, 1 Mar. 1976 - 30 Jun. 1977
R. E. Walters, J. B. Fanucci, P. W. Hill, and P. G. Migliore Jul. 1979 243 p refs
(Contract EY-76-C-05-5135)
(ORO-5135-77-5) Avail: NTIS HC A11/MF A01

Theoretical and experimental research accomplished in evaluating an innovative concept for vertical axis wind turbines (VAWT) is described. The concept is that of using straight blades composed of circulation controlled airfoil sections. The theoretical analysis was developed to determine the unsteady lift and moment characteristics of multiple-blade cross-flow wind turbines. To determine the drag data needed as input to the theoretical analysis, an outdoor test model VAWT was constructed; design details, instrumentation, calibration results, and initial test results are reported. Initial testing was with fixed pitch blades having cross-sections of conventional symmetrical airfoils. Costs of building the test model are included, as well as cost estimates for blades constructed with composite materials. These costs are compared with those of other types of wind turbines. DOE

N80-23847# Urban Systems Research and Engineering, Inc., Cambridge, Mass.
DIRECT REGIONAL ENERGY/ECONOMIC MODELING (DREEM) DESIGN Final Report
P. D. Hall and C. J. Pleatsikas Oct. 1979 146 p refs
(Contract EI-78-C-01-6345)
(DOE/EIA/6345-1) Avail: NTIS HC A07/MF A01

The use of regional and multiregional economic models for estimating the indirect and induced impacts of Federally-mandated energy policies was investigated. Alternative types of energy policies that can impact regional economics and the available analytical frameworks for measuring the magnitudes and spatial extents of these impacts were examined. The models capabilities for addressing various energy policy issues are summarized. Then the applicability of the model in specified contexts is demonstrated by developing appropriate input data for three scenarios. These scenarios concern the multi-state impacts of

alternative coal mining development decisions, multi-regional impacts of macroeconomic change, and the comprehensive effects of an alternative national energy supply trajectory. DOE

N80-23848# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
UNITED KINGDOM: ESTIMATES OF FUTURE ENERGY/GDP RELATIONSHIP
J. C. Gehman and Edward L. Allen Dec. 1979 106 p refs
(Contracts EY-76-C-05-0033; DE-AC05-76OR-00033)
(ORAU/IEA(M)-79-25) Avail: NTIS HC A06/MF A01

The UK economy is expected to grow in real terms due, for the most part, to advances in productivity. With productivity increasing, but at a declining rate, real GDP is projected at 50 percent above the 1976 level. The historical shift from goods production to services is expected to continue, but at a slower pace; by the year 2000 service output is expected to reach 55 percent of GDP. In the transport sector, the historical shift toward the passenger car is expected to saturate at about 70 percent of total ton-miles, while the shift toward truck freight is expected to continue and reach 76 percent of total ton-miles. Goods production is expected to stagnate and could fall to 33 percent of GDP by 2000. Historically, E/GDP has fallen steadily in the United Kingdom due almost exclusively to industrial conservation (investment in new and more efficient plant and equipment). Conservation should spread to all other sectors of the economy as a result of government policy. The E/GDP ratio is expected to fall by another 28 percent by the year 2000. This implies total energy consumption of 8.7 quads. DOE

N80-23849# Oak Ridge Associated Universities, Tenn. Inst. for Energy Analysis.
CANADA: ESTIMATES OF FUTURE ENERGY/GNP RELATIONSHIPS
E. L. Allen, James A. Edmonds, and R. Bruce Williamson Dec. 1979 61 p refs
(Contracts EY-76-C-05-0033; DE-AC05-76OR-00033)
(ORAU/IEA(M)-79-24) Avail: NTIS HC A04/MF A01

The Canadian economy expanded at an annual rate of 4.6 percent in the 1970s (GNP growth), second only to the remarkable record of Japan. In the future, Canadian economic development is expected to fall below past rates of achievement, primarily because of declining numbers of new entrants in the labor force. However, other factors affecting growth remain favorable. Canada, in particular, is virtually self-sufficient in energy. Government policy is to carry out a vigorous program of conservation, and to parallel this effort with domestic energy price increases which will move up to world levels over the next few years. As to economic growth, GNP expansion is expected to remain well above 3 percent a year for the balance of this century. Energy consumption is expected to grow from 7.51 Btu x 10 to the 15th power (quads) in 1976 to 13.3 quads by 2000. This means that energy growth, as a consequence of determined conservation, is expected to be about half as rapid as economic growth to 1990. DOE

N80-23850# Foster-Miller Associates, Inc., Waltham, Mass.
RESEARCH AND DEVELOPMENT OF AN AIR-CYCLE HEAT-PUMP WATER HEATER Final Report
John T. Dieckmann, Alve J. Erickson, Andrew C. Harvey, and William M. Toscano 1 Oct. 1979 343 p refs
(Contract W-7405-eng-26)
(ORNL/SUB-7226/1) Avail: NTIS HC A15/MF A01

A prototype reverse Brayton air cycle heat pump water heater was designed and built for residential applications. The system consists of a compressor/expander, an air-water heat exchanger, an electric motor, a water circulation pump, a thermostat, and fluid management controls. A potential residential market for the new high-efficiency water heater of approximately 480,000 units/y was identified. The retail and installation cost of this water heater is estimated to be between $500 and $600 which is approximately $300 more than a conventional electric water heater. As part of the design effort, a thermodynamic parametric analysis was performed on the water heater system. It was determined that to obtain a coefficient of performance of 1.7, the isentropic efficiency of both the compressor and the expander must be at least 85 percent. The selected mechanical configuration is described. DOE

N80-23851# BDM Corp., Albuquerque, N. Mex.
INVESTIGATION OF THE TECHNICAL AND ECONOMIC FEASIBILITY OF USING PUMPED WELL-WATER ENERGY STORAGE SYSTEMS Final Report
Dec. 1979 92 p refs
(Contract EY-76-C-04-0789)
(SAND-79-7096; BDM/TAC-79-518-TR-R1) Avail: NTIS HC A05/MF A01

Work completed on the three technical tasks of the project is summarized. The first task included a conceptual/preliminary system design, a selection of potential geographic locations in New Mexico for this system, and a study of relating institutional issues. The second task included a design of the baseline energy storage system with the identification of major components (off the shelf) and their associated performance estimates and a proposed site location within New Mexico. The third task area included an estimate of the capital cost for the storage system (e.g., cost of major components and processes, O and M costs) and an estimate of the potential annual fossil fuel savings. DOE

N80-23852# Toledo Univ., Ohio. College of Engineering.
PERFORMANCE IMPROVEMENT OF A SOLAR HEATING SYSTEM UTILIZING OFF-PEAK ELECTRIC AUXILIARY Semiannual Progress Report, 18 Jun. - 31 Dec. 1979
A. H. Eltimsahy Dec. 1979 10 p
(Contract DE-FG02-79R5-10140)
(DOE/R5/10140-1) Avail: NTIS HC A02/MF A01

A solar-assisted heat pump system, which was designed, installed, and operated in an experimental solar house, is described. The heat pump system is capable of operating in a wid range of temperatures which is needed in a solar house utilizing off-peak storage from the electric utility. The complete system consists of 584.1 square feet of flat plate solar collectors, a 5 horsepower compressor, an evaporator, a condensor, thermal storage units, and associated equipment. During the installation and initial operation of the system, numerous aspects of the feasibility of the system design were evaluated. Many of these aspects point to the potentially improved operating performance of a solar heating system utilizing off-peak storage from the electric utility. DOE

N80-23853# Sandia Labs., Albuquerque, N. Mex.
LOW COST STRUCTURES FOR PHOTOVOLTAIC ARRAYS
H. Post 1980 6 p refs Presented at the 14th Photovoltaics Specialists Conf., San Diego, Calif., 7 Jan. 1980
(Contract EY-76-C-04-0789)
(SAND-80-0142C; CONF-800106-9) Avail: NTIS HC A02/MF A01

The design and analysis of low cost, ground-mounted flat plate non-tracking array structures for use in large intermediate and central power station applications are described. Design requirements for the array structure, especially wind loading criteria, are discussed and problem areas associated with the integration of the module panel and support structure are identified. Support system costs which include site preparation, foundation and support structure, and installation costs are summarized. Wind effects data derived from comprehensive wind tunnel tests of flat plate array field models are presented and compared with wind loading estimates based on existing design standards. DOE

N80-23854# Massachusetts Inst. of Tech., Cambridge.
PROCESS APPLICATIONS FOR GEOTHERMAL ENERGY RESOURCES Progress Report
1 Oct. 1979 9 p
(Contract ET-78-S-02-4896)
(COO-4896-T1) Avail: NTIS HC A02/MF A01

Energy use characteristics of the major energy using industries in the US were examined. Using the pulp and paper industry, two analyses were performed of the potential for substituting geothermal energy for fossil fuel in specific plants. The lack of industry interest is discussed. DOE

N80-23855# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLAR PHOTOVOLTAIC PROJECT: MATERIALS, AND TESTING ACTIVITIES Quarterly Report, 1 Apr. - 1 Jun. 1979

S. E. Foreman and M. P. Themelis 31 Oct. 1979 36 p refs
(Contract EY-76-C-02-4094)
(COO-4094-60) Avail: NTIS HC A03/MF A01

Terrestrial photovoltaic modules were tested in the field to determine the extent of physical and electrical degradation which had taken place since previous inspections. Several modules were removed from the sites for more detailed laboratory analysis. In addition degradation analysis of modules from the rooftop of the Chicago Museum of Science and Industry, and failure analysis of modules from the Lincoln Laboratory Rooftop Test Bed and Residential Test Beds was performed. The results of both field testing and the laboratory analyses are reported. DOE

N80-23856# Midwest Research Inst., Kansas City, Mo. Solar Energy Research Inst.
SOLPOND: A SIMULATION PROGRAM FOR SALINITY GRADIENT SOLAR PONDS
Jon Henderson and Cecile M. Leboeuf Jan. 1980 7 p refs Presented at the 2nd Ann. Systems Simulation and Econ. Analysis Conf., San Diego, Calif., 23-25 Jan. 1980
(Contract EG-77-C-01-4042)
(SERI/TP-351-559; CONF-800101-4) Avail: NTIS HC A02/MF A01

A computer simulation design tool was developed to simulate dynamic thermal performance for salinity gradient solar ponds. Dynamic programming techniques allow the user significant flexibility in analyzing pond performance under realistic load and weather conditions. Finite element techniques describe conduction heat transfer through the pond, earth, and edges. Results illustrate typical thermal performance of salinity gradient ponds. Sensitivity studies of salty pond thermal performance with respect to geometry, load, and optical transmission are included. Experimental validation of the program with an operating pond is also presented. DOE

N80-23857# Brookhaven National Lab., Upton, N. Y.
SERIES SOLAR HEAT PUMP AND ENERGY CONSERVATION
Edward A. Kush 1979 24 p refs Presented at the 2nd Intern. Conf. on Alternative Energy Sources, Miami Beach, Fla., 10-13 Dec. 1979
(Contract EY-76-C-02-0016)
(BNL-27012; CONF-791204-13) Avail: NTIS HC A02/MF A01

An overview is given of the series solar heat pump concepts and the reasons why it can serve an important role in energy conversation in space heating. These are highlighted by elevated coefficients of performance (COP's) and the use of low temperature potentially inexpensive solar collectors. The characteristics required of the subsystems and integrated system are detailed. Particular emphasis is given to the performance of the heat pump itself at high temperature source conditions corresponding to those of solar input, and recent laboratory results which demonstrate very high COP's using practical components are shown. The reasons why the high COP's are a necessary but not sufficient condition for competitive overall system performance are detailed and methods for applying the high COP's to an effective solar assisted heat pump system are discussed. Ongoing development work in the field is summarized. DOE

N80-23858# Boeing Computer Services, Inc., Seattle, Wash. Energy Technology Applications Div.
DEVELOPING AND UPGRADING OF SOLAR SYSTEM THERMAL ENERGY STORAGE SIMULATION MODELS Technical Progress Report, 1 Sep. 1978 - 28 Feb. 1979
J. K. Kuhn, G. F. vonFuchs, and A. P. Zob May 1979 70 p refs
(Contract EG-77-C-02-4482)
(BCS-40252) Avail: NTIS HC A04/MF A01

The rock bed solar energy storage model selected for validation was further explored and compared to test data. Correlation with data from different experiments is showing improvement over the correlations reported earlier. Two more water tank models were obtained. Work is continuing with model testing, validation and evaluation. Additional laboratory test data on water tank performance was obtained. Some significant improvements were made in the SOLSYS algorithm resulting in a more powerful simulation tool referred to as the extended SOLSYS model. DOE

N80-23859# Battelle Pacific Northwest Labs., Richland, Wash.
SOLAR REFLECTOR MATERIALS
M. A. Lind 1979 23 p Presented at the USPE Seminar on High-Level Solar Energy, Seattle, 18 May 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7698; CONF-7905134-1) Avail: NTIS HC A02/MF A01

A overview is given of the current state-of-the-art in solar reflector materials which outlines the uses of reflectors in the solar industry and presents some insights into the operational and materials considerations that must be incorporated into the solar reflector design. Current problem areas and research goals are also emphasized. DOE

N80-23860# Battelle Columbus Labs., Ohio.
ANALYSIS AND DESIGN OF A 100-KILOWATT SOLAR PHOTOVOLTAIC FLAT-PANEL POWER SYSTEM FOR A MACHINING AND METALWORKING FACILITY IN COLUMBUS, OHIO. PHASE 1: PHOTOVOLTAIC FLAT PANEL APPLICATION EXPERIMENT Final Report, 1 Oct. 1978 - 28 Feb. 1979
G. T. Noel, G. Alexander, L. H. Stember, G. H. Stickford, J. H. Broehl, and D. C. Carmichael Albuquerque, N. Mex. DOE Mar. 1979 163 p
(Contracts ET-78-C-04-5395; DE-AC04-78ET-23055)
(DOE/ET/23055-1) Avail: NTIS HC A08/MF A01

A 100kW peak flat panel photovoltaic power system to supply power to a machine shop load in Columbus, Ohio was designed. The system will provide three-phase, 240 volt ac power to a machining and metal-working facility which has 100 pieces of machinery and employs 50 machinists and other craftsmen. The system will operate in parallel with the utility which will supply the backup power. Due to the close match of the array power output to the workday shop load, only a small amount of the power generated is excess to the concurrent shop demand. When there is any excess, it will be fed to alternate loads at the site, rather than into the utility grid. A system performance analysis indicates that the system will supply approximately 115,000 kWh/ year of electrical energy after all losses. The system uses high energy-density flat panel photovoltaic modules in a roof-mounted installation, and employs a microprocessor controlled power conditioning unit. DOE

N80-23861# Yardney Electric Corp., Pawcatuck, Conn.
RESEARCH, DEVELOPMENT AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report, 1978
Oct. 1979 64 p
(Contract W-31-109-eng-38)
(ANL/OEPM-78-12) Avail: NTIS HC A04/MF A01

The work carried on nickel zinc batteries over the past year was directed in three major areas: (1) elucidating the failure modes of the nickel-zinc battery system; (2) improving performance of the system; and (3) effecting a cost reduction program. Progress on the three areas is reported. DOE

N80-23862# Massachusetts Inst. of Tech., Cambridge. Aeroelastic and Structures Research Lab.
DYNAMICS OF A FLEXIBLE ROTOR-TOWER SYSTEM
Lennart S. Hultgren and John Dugundji Stockholm Aeronautical Research Inst. of Sweden Aug. 1979 99 p refs
(Contract SWEDBESD-5061.012)
(ASRL-TR-194-1; FFA-AU-1499) Avail: NTIS HC A05/MF A01

The dynamics of a horizontal axis wind turbine were analyzed. Both the blades and the tower are taken to be flexible. The analysis is linear and modal. For a three bladed rotor, numerical results were obtained for free vibrations and forced oscillations due to static unbalance. Analytical solutions were constructed for forced vibrations due to gravity and wind shear.
Author (ESA)

N80-23863# Rolls-Royce Ltd., Derby (England).
IDENTIFICATION SYSTEM FOR APPARATUS AND PLANT USED IN THERMAL POWER STATIONS

Horst Anders (Brown, Boverie and Co.), Philipp Freymeyer (Siemans AG), and Helmut Hotes (AEG Telefunken) 1979 30 p Transl. into ENGLISH of "System zur Kennzeichnung von Geraeten u. Anlagen in Waermekraftwerken", Elektrizitaetswirtschaft (Frankfurt), v. 6, 17 Mar. 1969 p 181-192 In ENGLISH and GERMAN
(PNR-90008; Trans-14884) Avail: NTIS HC A03/MF A01

The advantages of using a standard nomenclature for all equipment and apparatus used in thermal power stations are given, along with a list of the requirements which such a system would have to meet. A system covering both electrical and mechanical engineering is presented along with possible extensions. Experience gained in the use of the system is discussed. Author (ESA)

N80-23864# Metallgesellschaft, A.G., Frankfurt am Main (West Germany). Metall-Lab.
GRIDS FOR MAINTENANCE-FREE STORAGE BATTERIES MADE FROM LEAD-AKALINE EARTH METAL-ALLOYS Final Report
Ulrich Heubner, Gert Friedham, and Eberhard Nann Bonn Bundesmin. fuer Forsch und Technol. Sep. 1979 95 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-21) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 19,55

The production of lead-alkaline earth metal grids for use in acid-based batteries was investigated. Rolled strips of the alloy were processed into expanded metal grids showing sufficient mechanical strength, high electrical conductivity, and corrosion resistance. Batteries using these electrodes are maintenance-free and exhibit good cold cranking ability. Author (ESA)

N80-23865# European Space Agency, Paris (France).
PHOTOLYTIC DECOMPOSITION OF WATER INTO OXYGEN AND HYDROGEN AS AN ALTERNATIVE ENERGY UTILIZATION OF HOUSEHOLDS AND SMALL CONSUMERS
Wolfgang U. Wendelkamm Nov. 1979 54 p refs Transl. into ENGLISH of "Photolytisches Zersetzung von Wasser zu Wauerstoff und Wasserstoff als Alternative Energieversorgung von Haushalten und Kleinverbrauchern", Rept. DFVLR-FB-78-77 DFVLR, Trauen, West Germany, Jan. 1978 Original report in GERMAN previously announced as N79-30836 Original German report available from ZLDI, Munich DM 19,90
(ESA-TT-582; DFVLR-FB-78-17) Avail: NTIS HC A04/MF A01

The photolytic decomposition of water into oxygen and hydrogen is one of the possible alternatives for the transformation of solar energy into storable secondary energy for practical utilization by households and small consumers. After a survey of the possible cycles of water decomposition, the chemical and physical fundamentals of the photolytic decomposition of water using inorganic catalysts and sensitizers are described. Finally, a total house energy supply system is presented as one illustration of the application possibilities. Author (ESA)

N80-23866# Transportation Research Board, Washington, D.C. Commission on Sociotechnical Systems.
ENERGY POLICY IMPACT EVALUATION
Susan Singer-bart, ed., Raisin K. Mufti (Princeton Univ.), Michael J. Munson (Princeton Univ.), Kenneth Chomitz (California Univ., Irvine), Richard A. Margiotta (Tennessee Univ., Knoxville), Lawrence J. Reilly (Harvard Univ., Cambridge Mass.), David T. Hartgen (New York State Dept. of Transportation, Albany), Leon Rudman (DOE, Cambridge, Mass.), Robin Dubin (Johns Hopkins Univ., Baltimore), David L. Greene (ORNL, Tenn.) et al 1979 44 p refs Sponsored in part by DOE
(PB80-137953; TRB/TRR-726; ISBN-0-309-02979-1; LC-79-607912; ISSN-0361-1981) Avail: NTIS HC A03/MF A01; Paper copy also available from Transportation Res. Board, 2101 Constitution Ave., Washington, D. C. 20418 CSCL 10A

Five papers are presented which deal with the following areas: approach to assessing the impact of energy conservation policies on transportation demand; survey and analysis of energy intensity estimates for urban transportation modes; foreign oil dependence; state-level analysis; vehicle kilometers traveled; evaluation of existing data sources; and multivariate classification of automobiles by use of an automobile characteristics data base. GRA

N80-23867# National Bureau of Standards, Washington, D.C.
SOLAR ENERGY SYSTEMS: TEST METHODS FOR COLLECTOR INSULATIONS
McClure Godette, Jack Lee, and James Fearn Oct. 1979 40 p Sponsored in part by DOE
(PB80-132038; NBSIR-79-1908) Avail: NTIS HC A03/MF A01 CSCL 10A

A preliminary study was performed to evaluate potential procedures for screening the insulation used in collectors. Both standard test methods and newly developed non-standard procedures were used to evaluate twenty-one insulation materials. The insulation parameters measured were selected on the basis of how and to what extent they were affected by the unique environmental conditions within solar collectors. Results of the laboratory tests are discussed and those procedures which offer a potential for screening insulations used in solar collectors are presented. GRA

N80-23868# National Bureau of Standards, Washington, D. C. Structures and Materials Div.
SOLAR ENERGY SYSTEMS: STANDARDS FOR RUBBER HOSE
Robert D. Stiehler and John L. Michalak Nov. 1979 38 p Sponsored in part by DOE
(PB80-129828; NBSIR-79-1917) Avail: NTIS HC A03/MF A01 CSCL 10A

A study of commercial rubber hose was made to develop standards for hoses used in solar energy systems. Twelve hoses were evaluated by cycling between temperatures of about 100 C and temperatures as low as -40 C during a period of about seven months. Laboratory tests for bursting strength, compatibility with metals, compression set, ozone resistance, and water vapor transmission were also made. The results of the tests are presented. Based on these findings a standard for rubber hose used in solar energy systems is proposed. GRA

N80-23869# National Bureau of Standards, Washington, D.C.
SOLAR COLLECTOR FLUID PARAMETER STUDY Final Report, Nov. 1978 - Jun. 1979
Wallace W. Youngblood, William Schultz, and Ralph Barber Oct. 1979 130 p
(Contract EG-77-C-01-4050)
(PB80-125891; NBS-GCR-79-184) Avail: NTIS HC A07/MF A01 CSCL 10A

A series of instantaneous thermal performance tests were performed on four differently constructed, commercially available flat plate solar collectors with each of four commonly used heat transfer fluids. The tests were designed to illustrate the magnitude of fluid parameter effects on the thermal performance of flat plate solar collectors. The configurations were selected to provide a broad variety of flow conditions. The heat transfer fluids used were as follows: (1) water; (2) an ethylene glycol (Prestone 11) water solution (50 percent by weight); (3) a silicone based heat transfer fluid (SLYTHERM 444); and (4) a synthetic hydrocarbon (Therminol 44). GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N80-23870 Stanford Univ., Calif.
PROBABILITY MODELING AND ESTIMATION FOR HOURLY VARIATION OF AIR POLLUTION CONCENTRATIONS Ph.D. Thesis
Chen-Hui Lisa Foo 1980 57 p
Avail: Univ. Microfilms Order No. 8011635

A probability model is presented which describes the behavior of high pollutant concentrations. The model characterizes the variation of hourly average concentration, after a suitable normalization, as the superposition of a daily random effect and an hourly random effect. Without the daily random effect this model becomes one for repeated measurements on the

autoregressive process of order one. Without the hourly random effect, it becomes a variance components problem. The maximum likelihood estimates of the model parameters are derived. A particular set of mid-day oxidant data were chosen from San Jose Piedmont monitoring station. The maximum likelihood estimates are obtained for the data in which the estimated daily random effect is very small. The estimation of the probabilities of threshold exceedances of mid-day oxidant concentrations is also studied. Sensitivity analysis was done on the estimation of the above probabilities by varying the model parameters.
Dissert. Abstr.

N80-23871 Kentucky Univ., Lexington.
DEVELOPMENT OF A REGIONAL TRANSPORT/TRANSFORMATION/REMOVAL MODEL FOR SO2 AND SULFATE IN THE EASTERN UNITED STATES Ph.D. Thesis
Gregory Richard Carmichael 1979 358 p
Avail: Univ. Microfilms Order No. 8010494

A combined transport-chemistry model that describes the regional distribution of SO2 and sulfate within the lower troposphere is developed. The mathematical analysis is based on the coupled three dimensional advection-diffusion equations for SO2 and sulfate and incorporates chemical transformations as well as the physical phenomena of dry deposition at the surface and wet deposition. The analysis also considers spatial variations in topography and spatial and temporal variations in both the mixing layer heights and the wind field. The dynamic model employs a Galerkin method for the numerical solution of the partial differential equations. Results from a series of numerical experiments show the Galerkin method to be superior, in terms of accuracy and computation time, to the finite difference methods tested. Numerical results studying the interactions of convection, diffusion, chemical reaction, pollutant removal, and the effects of contaminant emission source strength, source location and multiple sources are also presented. Dissert. Abstr.

N80-23872 Texas Univ. Health Science Center, Houston.
SEASONAL AND GEOGRAPHICAL DISTRIBUTION OF PRIMARY AMINES IN HOUSTON ATMOSPHERE Ph.D. Thesis
Chi-Ping Jack Peng 1979 129 p
Avail: Univ. Microfilms Order No. 8010902

The seasonal and geographical distribution pattern of airborne primary amines in the Houston atmosphere is examined. Free primary amines, amine salts, and pollens in the air were collected on glass fiber filters by means of a high volume sampler. Acid digestion dissolved the free amines, their salts, and pollens from the filter paper into solution. Fluorescamine was used as the fluorescent reagent. Fluorophor was quantified with a spectrophotofluorometer with high specificity and sensitivity. A total of 15 sets of samples were collected. Each set of samples consisted of 25 to 29 specimens which were collected at 29 different stations around the Houston area. Multiple regression analysis was applied to assess the role of different meteorological factors on the variation of amines. The SYMAP technique was used to show amine variations across the city and thus suggested possible sources for amines. Dissert. Abstr.

N80-23873 Pennsylvania State Univ., University Park.
THE CHEMICAL TRANSFORMATION OF SULFUR DIOXIDE TO SULFATE IN THE PLUME OF THE COAL-BURNING KEYSTONE POWER PLANT Ph.D. Thesis
Allen Conrad Dittenhoefer 1979 137 p
Avail: Univ. Microfilms Order No. 8010048

Measurements of the oxidation rate of sulfur dioxide to sulfate particles were made in the plume of the coal-fired Keystone power plant using instrumented aircraft. Aerosol number concentrations in nine distinct size intervals spanning the range 0.01-2.0 micrometer diameter were obtained using a condensation nucleus counter, an optical particle counter, and an electrical aerosol analyzer. These measurements were combined with cascade impactor sampling and quantitative sulfate analysis of individual plume and background particles using a transmission electron microscope to determine the mass concentration of sulfate at various positions in and out of the plume. From cross sectional plume mappings of the horizontal and vertical concentration profiles of SO2 and sulfate mass it was possible to calculate the SO2 conversion rate in the plume. It was found that although plume sulfate particle size distributions were highly dependent on both ambient relative humidity and solar radiative flux, relative humidity was the predominant parameter governing the SO2 transformation rate within the initial one to two hours of plume transport. Dissert. Abstr.

N80-23874*# Virginia Univ., Charlottesville. Engineering Sceinces Research Labs.
EVALUATING AND MINIMIZING NOISE IMPACT DUE TO AIRCRAFT FLYOVER Final Report
Ira D. Jacobson May 1980 78 p refs
(Grant NsG-1509)
(NASA-CR-153187; UVA/528186/MAE80/102) Avail: NTIS HC A05/MF A01

The results of a study on the evaluation and reduction of noise impact to a community due to aircraft landing and takeoff operations are presented. The case of multiple aircrafts flying on several trajectories, for either approach/landings or takeoffs was examined. An extremely realistic model of the flight path was developed. The annoyance criterion used was the noise impact index (NII). The algorithm was applied to Patrick Henry International Airport. R.E.S.

N80-23875*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ASSESSMENT OF POTENTIAL EXPOSURE TO FRIABLE INSULATION MATERIALS CONTAINING ASBESTOS
Walter S. Kim and David E. Kuivinen Apr. 1980 41 p refs
(NASA-TM-81435; E-359) Avail: NTIS HC A03/MF A01 CSCL 13B

Asbestos and the procedures for assessing potential exposure hazards are discussed. Assessment includes testing a bulk sample of the suspected material for the presence of asbestos, and monitoring the air, if necessary. Based on field inspections and laboratory analyses, the health hazard is evaluated, and abatement measures are taken if a potential hazard exists. Throughout the assessment and abatement program, all applicable regulations are administered as specified by the Environmental Protection Agency and the Occupational Safety and Health Administration. R.E.S.

N80-23876# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN FOR BIOMASS ENERGY SYSTEMS
Sep. 1979 56 p refs
(DOE/EDP-0032) Avail: NTIS HC A04/MF A01

Key elements of the Biomass Energy Systems Program are briefly described. Significant environmental concerns and requirements are identified. These include effects on soil erosion, soil quality, water quality, ecosystems, and air quality. J.M.S.

N80-23877# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN: GEOTHERMAL ENERGY SYSTEMS
Aug. 1979 77 p refs
(DOE/EDP-0036) Avail: NTIS HC A05/MF A01

All current and planned activities of the DOE Geothermal Energy Systems Program are covered. Major elements of this program include exploration of resources, confirmation of reservoirs, development of energy extraction systems, demonstration of utilization systems, identification and removal of institutional barriers, and a loan guaranty program. Environmental concerns and requirements for resolution of these concerns are discussed in detail. In terms of immediate need and importance in getting power online, the emission of H2S is the most important concern and the demonstration of an effective abatement system is the most significant requirement. Other significant concerns are the management or disposal of spent geothermal fluids, the potential of land subsidence, questions of water availability for heat rejection systems, land use conflicts, and socio-economic and cultural problems. The requirements to appropriately research and mitigate these and other concerns in time to permit orderly and timely development of geothermal energy systems are presented. J.M.S.

N80-23878# California Univ., Livermore. Lawrence Livermore Lab.

POTENTIAL AIR QUALITY IMPACT OF GEOTHERMAL POWER PRODUCTION IN THE IMPERIAL VALLEY
P. H. Gudiksen, D. L. Ermak, K. C. Lamson, M. C. Axelrod, and R. A. Nyholm Oct. 1979 42 p refs
(Contract W-7405-eng-48)
(UCRL-52797) Avail: NTIS HC A03/MF A01

A regional assessment of the potential impact on air quality of developing the Imperial Valley's geothermal resources for power production is presented. A network of six stations was installed to characterize the air quality and atmospheric transport properties for the valley before development. These measured the ambient air concentrations of H2S, SO2, O3, NO, NO/x, CO2, Hg, Rn, and particulates. The geothermal fluids were analyzed chemically to estimate potential emission rates from future power plants. Using these data and advanced air quality modeling led to the prediction of the potential valley-wide impact of a 3000 MW development scenario. The impact analysis reveals that H2S is the principal gaseous pollutant of concern. The ambient H2S concentrations that would result from generating 3000 MW without emission controls exceed the California air quality standard (30 ppb) at least 1% of the time for an area in the northern part of the valley that is roughly 1500 sq km in size. DOE

N80-23879# Battelle Pacific Northwest Labs., Richland, Wash. Atmospheric Sciences Dept.
EVALUATION OF EMPIRICAL ATMOSPHERIC DIFFUSION DATA
T. W. Horst, J. C. Doran, and P. W. Nickola Oct. 1979 151 p refs
(Contract EY-76-C-06-1830)
(NUREG-CR-0789; PNL-2599) Avail: NTIS HC A08/MF A01

A study was made of atmospheric diffusion over level, homogeneous terrain of contaminants released from non-buoyant point sources up to 100 m in height. Current theories of diffusion are compared to empirical diffusion data, and specific dispersion estimation techniques are recommended which can be implemented with the on-site meteorological instrumentation required by the Nuclear Regulatory Commission (NRC). A comparison of both the recommended diffusion model and the NRC diffusion model with the empirical data demonstrates that the predictions of the recommended model have both smaller scatter and less bias, particularly for groundlevel sources. DOE

N80-23880# Battelle Pacific Northwest Labs., Richland, Wash.
MATHEMATICAL MODELS FOR ATMOSPHERIC POLLUTANTS. APPENDIX C: GOVERNING EQUATIONS FOR ATMOSPHERIC TRACE CONSTITUENTS AND SOLUTION TECHNIQUES Final Report
R. L. Drake Aug. 1979 252 p refs Sponsored in part by Electric Power Research Inst.
(Contract EY-76-C-06-1830)
(EPRI-EA-1131-App-C) Avail: NTIS HC A08/MF A01

The governing equations for the evolution and fate of airborne gases and particles are described, and exact and approximate solution techniques are presented. Among the systems of equations are: the conservation of mass, momentum and energy and the equations of state for defining the motion, pressure, density and temperature fields of the atmosphere; the conservation of liquid water and water vapor; the radiation equations for the solar and terrestrial radiation intensities; the conservation equations for non-reactive and reactive gases and aerosols. The techniques for obtaining exact solutions of diffusion and aerosol equations are: series methods, integral transforms, similarity techniques, principle of superposition and Green's functions. Among the approximate solution techniques described in this document are: the classical techniques, such as successive approximations, asymptotic techniques, perturbation methods, the method of moments and integral methods; random walk and Monte Carlo techniques; finite difference methods and spectral and variational methods, including finite element techniques. DOE

N80-23881# Department of Energy, Washington, D. C. Div. of Technology Assessments.
ENVIRONMENTAL DEVELOPMENT PLANS FOR ENERGY TECHNOLOGY PROGRAMS Summary Report
Oct. 1979 110 p
(DOE/EDP-0062) Avail: NTIS HC A06/MF A01

A review of 30 environmental development plans prepared in 1979 covering the Department of Energy's programs in the solar geothermal conservation, fossil, and nuclear energy technology areas is presented. For each area, the key environmental, health and safety concerns are identified, and the research required to resolve the concerns is discussed. Abbreviated milestones for technology and environmental activities are presented, and the completion dates for mandated environmental documents are summarized. DOE

N80-23882# Battelle Pacific Northwest Labs., Richland, Wash.
AEROSOL, TRACE ELEMENTS AND VISIBILITY MEASUREMENTS IN MOUNTAINOUS TERRAIN
M. M. Orgill, N. S. Laulainen, D. R. Drewes, and R. N. Lee Jan. 1979 10 p refs Presented at the 19th Ann. Meeting of the Inst. of Environ. Sci., Seattle, 30 Apr. - 2 May 1979 Submitted for publication
(Contract EY-76-C-06-1830)
(PNL-SA-7576; CONF-790445-7) Avail: NTIS HC A02/MF A01

Data on the relationships between aerosols, trace elements, and visibility in mountainous terrain and air pollutants from existing industrial, urban, agricultural and transportation sources in the Pacific Northwest states of Washington, Oregon, and Idaho were analyzed. Data were obtained by airborne instruments. Twelve sampling flights provided data on scattering extinction coefficient, trace elements, sulfate, and ozone during relatively good prevailing visibility conditions. Over 80 percent of the sample flights indicated that the meteorological range was 20 km or more. Four or five of the sampling flights indicated the presence of visibility reducing haze. Relatively higher concentrations of certain crustal and anthropogenic trace elements and sulfate (associated with high relative humidities) resulted in degradation of meteorological range in the foothills of Cascades, Snoqualmie Pass and Kittitas Valley and Columbia River Gorge. DOE

N80-23883# Institute of Ecology, Indianapolis, Ind.
ROLE OF TEMPERATE ZONE FORESTS IN THE WORLD CARBON CYCLE: PROBLEM DEFINITION AND RESEARCH NEEDS
Thomas V. Armentano, ed. and J. Hett, ed. Jul. 1979 69 p refs Workshop held in Indianapolis, 21-22 Mar. 1979
(Contract DE-AC02-79EV-10040)
(DOE/ET/10040-1) Avail: NTIS HC A04/MF A01

Carbon uptake and losses from temperate zone forests are reported. The forest inventory data reviewed suggest the temperate zone forests could have functioned for the past several decades as a net sink for 10 to the 9th power tons of carbon annually. However, due to the limited data on noncommercial timberlands, nonmerchantable tree components, and soil organic matter changes, the precision of this estimate of temperate zone C retention may be only within one-quarter to one-half of the true value. Despite this limitation, the data suggest strongly that temperate zone forests probably are not a source of carbon. The principal areas for which new information would reduce uncertainties in estimates of carbon uptake and losses from temperate zone forests are discussed, and recommendations are made for a series of research initiatives to increase resolution of the problem areas. DOE

N80-23884# Battelle Pacific Northwest Labs., Richland, Wash.
MATHEMATICAL MODELS FOR ATMOSPHERIC POLLUTANTS. APPENDIX D: AVAILABLE AIR QUALITY MODELS Final Report
R. L. Drake, D. J. McNaughton, and C. Wang Aug. 1979 140 p refs Sponsored in part by DOE
(EPRI Proj. 805)
(EPRI-EA-1131-App-D) Avail: NTIS HC A07/MF A01

Models that are available for the analysis of airborne pollutants are summarized. In addition, recommendations are given concerning the use of particular models to aid in particular air quality decision making processes. The air quality models are characterized in terms of time and space scales, steady state or time dependent processes, reference frames, reaction mechanisms, treatment of turbulence and topography, and model uncertainty. Using these characteristics, the models are classified in the following manner: simple deterministic models, such as air pollution indices, simple area source models and rollback models;

statistical models; such as averaging time models, time series analysis and multivariate analysis; local plume and puff models; box and multibox models; finite difference or grid models; particle models; physical models, such as wind tunnels and liquid flumes; regional models; and global models. DOE

N80-23885# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
INVESTIGATING THE NOISE POLLUTION PROBLEM. A THEORETICAL MODEL [ONDERZOEK NAAR GELUIDHINDER. EEN THEORETISCH MODEL]
R. G. deJong Jan. 1978 19 p In DUTCH
(IG-Publ-663) Avail: NTIS HC A02/MF A01

The methodology of the social scientist is explained as applied to the study of noise pollution. Through use of a model, psychological concepts are introduced showing how noise is perceived and assimilated. The role of social science research in the Institute is elaborated, and its integration into the technical, physical, legal, economic and medical approaches to noise pollution is described. Author (ESA)

N80-23886# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands).
MONITORING DUST CONCENTRATIONS. MODIFICATIONS TO THE DUST MONITOR FH62A [REGISTREREND STOFCONCENTRATIEMETINGEN. VOORZIENING AAN DE STAUBMONITOR FH62A (NR. 268) VOOR HET ONDERDRUKKEN VAN STORINGEN TIJDENS HET REGISTREREN VAN GROTERE AANTALLEN MEETGEGEVENS]
W. C. Duba Apr. 1978 6 p In DUTCH
(IG-TNO-F-1468) Avail: NTIS HC A02/MF A01

Modifications to the Staubmonitor FHG2A commercial monitor to decrease the cycle time, improve precision, and allow quick look determinations of concentrations are described. A method is proposed for attaching the instrument to a data recorder to facilitate data processing with a computer. Author (ESA)

N80-23887# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
PROJECT FILTER HOLDER. TESTS ON 25 mm DUST FILTER HOLDERS [ONTWERP FILTERHOUDER. ONTWERP VAN NIEUWE FILTERHOUDER 25 mm EN HET TESTEN VAN DRIE TYPEN FILTERHOUDERS 25 mm]
W. C. Duba Apr. 1978 19 p In DUTCH
(IG-TNO-F-1638) Avail: NTIS HC A02/MF A01

Designs are presented for dust filter holders suitable for use in air pollution monitoring equipment. Design principles were determined which overcome problems such as lateral filtration and leaks. Interchangeable parts permit different methods of sampling using the same basic equipment. Author (ESA)

N80-23888# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Binnenlucht.
COMPARATIVE INVESTIGATION INTO THE RELIABILITY OF VARIOUS ANALYSIS METHODS FOR FORMALDEHYDE IN AIR [ONDERZOEK BEPALINGSMETHODEN FORMALDEHYDE. VERGELIJKEND ONDERZOEK NAAR DE BETROUWBAARHEID VAN VERSCHILLENDE BEPALINGSMETHODEN VOOR FORMALDEHYDE IN LUCHT]
I. J. F. vanderWal Oct. 1978 10 p In DUTCH
(IG-TNO-F-1643) Avail: NTIS HC A02/MF A01

Three spectrophotometric methods are being studied for determining concentrations of formaldehyde in air for routine use in pollution monitoring systems. Sensitivity test results from four laboratories are presented. Author (ESA)

N80-23889# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3, FLUSHING: AIR POLLUTION IN 1976 [NOx EN O3. VLISSINGEN. HET ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT IN VLISSINGEN IN 1976]
E. J. G. Goudena Mar. 1978 53 p In DUTCH
(IG-TNO-G-675) Avail: NTIS HC A04/MF A01

Reduced data for nitrogen oxides and ozone taken at Flushing, the Netherlands, show that the American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded on 130 days. The Japanese limit and EPA limit for hourly average ozone concentrations were exceeded 100 days and 50 days, respectively. Author (ESA)

N80-23890# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3, VLAARDINGEN: AIR POLLUTION IN 1976 [NOx EN O3. VLAARDINGEN. ONDERZOEK NAAR DE VERONTREINIGIN DE BUITENLUCHT TE VLAARDINGEN IN 1976]
E. J. G. Goudena Mar. 1978 49 p In DUTCH
(IG-TNO-G-678) Avail: NTIS HC A03/MF A01

Reduced data for nitric acid and ozone taken at Vlaardingen, Netherlands, show that the American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded on 214 days. The Japanese limit and EPA limit for hourly average ozone concentrations were exceeded 95 and 48 days, respectively. Author (ESA)

N80-23891# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
AIR POLLUTION AT SCHOUWEN-DUIVELAND, 1976 [LUCHTVERONTREINIGING SCHOUWEN - DUIVELAND LUCHTVERONTREINIGINGSMETINGEN IN 1976 OP HET PILOTSTATION HAAMSTEDE OP SCHOUWEN-DUIVELAND]
J. A. F. deVreede Apr. 1978 98 p refs In DUTCH
(IG-TNO-G-679) Avail: NTIS HC A05/MF A01

Data are presented for NO, NO2, and O3 for the year, with incomplete readings for PAN, C1 - C5, and THC. Correlations by month, by day of week, and time of day are shown. A good correlation exists between increased ozone and PAN. Author (ESA)

N80-23892# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
AIR POLLUTION IN DELFT, 1977 [LUCHTVERONTREINIGING IN DELFT. ONDERZOEK NAAR DE BUITENLUCHTVERONTREINIGING IN DELFT IN 1977]
E. J. G. Goudena Dec. 1978 108 p In DUTCH
(IG-TNO-G-764) Avail: NTIS HC A06/MF A01

Data are presented for NO, NO2, O3, PAN, and CO. Measurements were also made of UV intensity. The American limit for average NO2 concentration level over one year was not exceeded, while the Japanese limit was exceeded on 185 days. The Japanese limit and the EPA limit for hourly average ozone concentration were exceeded on 25 and 6 days, respectively. Author (ESA)

N80-23893# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3. FLUSHING: AIR POLLUTION IN 1977 [NOX EN O3. VLISSINGEN. HET ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT IN VLISSINGEN IN 1977]
E. J. G. Goudena Sep. 1978 46 p In DUTCH
(IG-TNO-G-765) Avail: NTIS HC A03/MF A01

Reduced data for NOx and O3 concentrations taken at Flushing, the Netherlands are presented. The American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded in 64 days. The Japanese limit and Environmental Protection Agency limit for hourly average ozone concentrations were exceeded in 10 days and 4 days respectively. Author (ESA)

N80-23894# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.
NOx AND O3, VLAARDINGEN: AIR POLLUTION IN 1977 [NOx EN O3. VLAARDINGEN. ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT TE VLAARDINGEN IN 1977]
E. J. G. Goudena Sep. 1978 48 p In DUTCH
(IG-TNO-G-766) Avail: NTIS HC A03/MF A01

Reduced data for nitrogen oxide and ozone taken at Vlaardingen, Netherlands, show that the American limit for average NO2 concentration over a one year period was not exceeded. The Japanese limit was exceeded on 183 days. The Japanese limit and EPA limit for hourly average ozone concentration were exceeded 19 days and 5 days, respectively. Author (ESA)

N80-23895# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.

AIR POLLUTION IN DELFT. MEASUREMENTS OF SMOKE DURING 1977 IN DELFT AND NAALDWIJK [VERONTREINIGING BUITENLUCHT DELFT. ONDERZOEK NAAR HET STANDAARDROOKGEHALTE VAN DE BUITENLUCHT TE DELFT EN NAALDWIJK IN 1977]

J. J. vanGiezen and H. J. Geevers Feb. 1978 29 p In DUTCH

(IG-TNO-G-768) Avail: NTIS HC A03/MF A01

Smoke concentration measurements for the two cities were combined for the first time in 1977. A 70 percent reduction was noted over previous years. Highest concentrations appear between 6 and 10 hours on work days, with a peak occurring Wednesday. Author (ESA)

N80-23896# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.

FLUORIDE MEASUREMENTS IN SOUTHERN NETHERLANDS. MEASUREMENTS AT DELFT, NAALDWIJK AND MAASLAND DURING 1977 [FLUORMETINGEN IN ZUID-HOLLAND. METINGEN MET 10-VOUDIGE MONSTERNEMINGSAPPARATEN TE DELFT, NAALDWIJK EN MAASLAND GEDURENDE HET JAAR 1977]

J. J. vanGiezen Mar. 1978 22 p In DUTCH

(IG-TNO-G-769) Avail: NTIS HC A02/MF A01

Measurements were made with semiautomatic sampling instruments. Frequency distributions and cumulative distributions are given. Little change was noted from concentrations measured in previous years. No instance of concentrations higher than 3.3 micrograms F per cu m in a 24 hour period was found. Author (ESA)

N80-23897# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.

AIR POLLUTION STUDIES IN THE NIEUWE-WATERWEG REGION USING DEPOSIT GAGES, 1977 DATA [VERONTREINIGING BUITENLUCHT NIEUWE WATERWEG HET ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT IN HET NIEUWEWATERWEG-GEBEIDMET OMGEVING M.B.V. NEERSLAGVANGERS EN LUIKSE BOLLEN IN 1977]

J. J. vanGiezen Feb. 1978 40 p refs In DUTCH

(IG-TNO-G-771) Avail: NTIS HC A03/MF A01

The location of sampling stations are given, and some comparisons made with data from the previous year. Large variations in weight of precipitation dust and ash were observed. The percentage of iron increased somewhat, in one case 100 percent. The percentage of fluorides has remained constant. Measurements were made with liege bulbs and the British Standard Deposit Gauge. Some computations of the possibility of corrosion occurrence were made. Author (ESA)

N80-23898# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.

SO2 MEASUREMENTS IN ROTTERDAM: VOLUMETRIC SO2 DETERMINATIONS, APRIL 1977 TO MARCH 1978 [SO2-METINGEN. DE METINGEN MET EEN VOLUMETRISCH SO2-APPARAAT IN ROTTERDAM VAN APRIL 1, 1977 TOT MARCH 31, 1978]

J. J. vanGiezen Oct. 1978 40 p refs In DUTCH

(IG-TNO-G-794) Avail: NTIS HC A03/MF A01

Monitoring and analysis procedures are described for SO2 and standard smoke measurements. Variations of concentration by season, and as a function of temperature and wind direction are given. Increases in both smoke and SO2 values over the previous year were observed. Maxima were noted Sundays and Mondays. Author (ESA)

N80-23899# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.

MEASURING TECHNIQUES FOR NO2 [IJKMETHIDEN NO2. EEN INLEIDEND ONDERZOEK NAAR AFWIJKINGEN IN DE AFGIFTE VAN NO2-PERMEATIEBUIZEN]

L. F. Heidema Mar. 1978 12 p In DUTCH

(IG-TNO-G-852) Avail: NTIS HC A02/MF A01

Experiments were performed showing that differences exist between gravimetrically determined amounts of NO2 from a reference source, and the actual emission. The deviation was greater at concentrations of 800 micrograms NO2 per cu m than with lower concentrations. Explanations for the phenomenon include contamination of the NO2 and incorrect weighing methods. Author (ESA)

N80-23900# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.

PAN: MEASUREMENTS AT DELFT IN 1974 [PAN-METINGEN TE DELFT IN 1974]

R. Bos Sep. 1978 20 p In DUTCH

(IG-TNO-G-866) Avail: NTIS HC A02/MF A01

Concentration data for PAN (peroxyacetylnitrate) taken at Delft, the Netherlands, are given. Variations by month, time of day, and day of the week are presented. The highest concentration measured was 3.8 ppb. Author (ESA)

N80-23901# Research Inst. for Environmental Hygiene, TNO, Delft (Netherlands). Afdel. Buitenlucht.

NOx AND O3. AIR POLLUTION IN 1973 [NOx EN O3. VLAARDINGEN. ONDERZOEK NAAR DE VERONTREINIGING VAN DE BUITENLUCHT TE VLAARDINGEN IN 1973]

E. J. G. Goudena Oct. 1978 48 p In DUTCH

(IG-TNO-G-867) Avail: NTIS HC A03/MF A01

Reduced data for NOx and O3 taken at Vlaardingen, Netherlands show that the American limit for average NO2 concentration over a one year period was not exceeded, but the Japanese limit was exceeded on 16 days. The number of days on which the Japanese standard and the EPA standard for hourly average ozone concentrations have been exceeded were respectively 12 and 7 days. Author (ESA)

N80-23902# Bristol Univ. (England). Dept. of Aeronautical Engineering.

AN INVESTIGATION INTO THE INITIAL MIXING AND DILUTION OF IDENTICAL PLUMES FROM MULTIPLE STACK CONFIGURATIONS B.S. Thesis

G. R. Burton and A. J. R. Hope Jun. 1979 65 p refs

(BU-233) Avail: NTIS HC A04/MF A01

The interaction between nonbuoyant plumes was studied using a flow visualization technique to examine the initial mixing and a mass spectrometer to investigate the development and dilution of the plumes. The wind tunnel and compressed air system used during the study are described along with the experimental procedures. The variation of resultant plume due to stack configuration changes is discussed. Author (ESA)

N80-23903# Environmental Protection Agency, Research Triangle Park, N.C. Office of Air Quality Planning and Standards.

SAROAD (STORAGE AND RETRIEVAL OF AEROMETRIC DATA) INFORMATION Final Report

Jacob G. Summers Feb. 1979 71 p refs

(PB80-133838; EPA-450/4-79-005) Avail: NTIS HC A04/MF A01 CSCL 13B

The storage and retrieval of aerometric data (SAROAD) system is described for an individual who is unfamiliar with SAROAD. The booklet includes: (1) an overview of the data contained in SAROAD, (2) an explanation of available air quality publications, (3) a description of procedures for requesting data, and (4) a description and example of the most important computerized reports. GRA

N80-23904# Pullman Kellogg, Houston, Tex.

ENVIRONMENTAL STANDARDS FOR COAL CONVERSION PROCESSES. VOLUME 1: MOST STRINGENT, FEDERAL, AND SELECTED STATE REGULATIONS Final Report, Feb. 1977 - Jan. 1979

D. K. Webber and D. E. Whittaker Oct. 1979 268 p refs (Contract EPA-68-02-2198)

(PB80-126980; EPA-600/7-79-231-A) Avail: NTIS HC A12/MF A01 CSCL 13B

Existing and proposed environmental standards are synopsized as a guide for evaluating the efficiency of available and developing technology for controlling liquid, gaseous, and solid wastes from coal conversion processes. Within the U.S., the Federal (including EPA) standards and guidelines for air, water, and solid wastes were gathered together with standards for 22 states (selected

for their potential in installing coal conversion facilities) and two regional commissions. Because environmental effects can cross national borders, standards and guidelines for Mexico, the Dominion of Canada, two Canadian provinces, and the international Joint Commission of U.S. and Canada were synopsized and added to the U.S. standards. All standards and guidelines are compared; from them the most stringent standards are summarized. GRA

N80-23905# Environmental Protection Agency, Research Triangle Park, N.C. Environmental Criteria and Assessment Office.
AIR QUALITY CRITERIA FOR OZONE AND OTHER PHOTOCHEMICAL OXIDANTS
Apr. 1978 372 p refs
(PB80-124753; EPA-600/8-78-004) Avail: NTIS HC A16/MF A01 CSCL 13B

Current knowledge regarding the origin of ozone and other photochemical oxidants is presented and assessed. Data on the effects of oxidant/ozone in the ambient air on man, vegetation, and ecosystems are summarized. The effects that have been observed will form the scientific basis for supporting the present National Ambient Air Quality Standard of 160 micrograms/cu m (0.08 ppm) or a revised standard. In this document, toxic organics are considered only with respect to eye irritation. The studies and data cited constitute the best available basis for specific standards aimed at protecting human health and the environment from photochemical oxidants in ambient air. GRA

N80-23906# Environmental Sciences Research Lab., Research Triangle Park, N.C.
ANALYSIS OF HIGH SULFATE CONCENTRATIONS IN GREATER NEW YORK CITY AIR Technical Report, Dec. 1978 - Aug. 1979
Gerard A. DeMarrais and Dale H. Coventry Dec. 1979 43 p refs
(PB80-128515; EPA-600/4-79-074) Avail: NTIS HC A03/MF A01 CSCL 04B

The meteorological phenomena which occurred during April 15 to 21, 1976, when high sulfate concentrations were measured in the New York City area, are summarized. Relationships between meteorological phenomena and high sulfate concentrations are compared to these findings. Since ozone readily occurs with the same meteorological conditions that are associated with sulfate episodes, the ozone concentrations are also discussed. Results show that the current procedure for sampling sulfate every sixth day does not provide sufficient data for determining how sulfate concentrations relate to meteorological phenomena. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N80-23907 Colorado Univ. at Boulder.
THE FREQUENCY DEPENDENCE OF Q Ph.D. Thesis
Gary Michael Lundquist 1979 281 p
Avail: Univ. Microfilms Order No. 8011290

That the fractional energy loss per cycle of an harmonic wave,Q(-1), is a function of the frequency, w, of the cycle is demonstrated and models of Q(-1) (w)-vs-depth which meet all available constraints are presented. Empirical observations on the value and depth dependence of the relaxation time (tau sub 2)are made in the frequency domain. The average position of tau sub 2 over teleseismic raypaths is found by fitting observed body-wave source spectra to a range of theoretical models. The results show that Q must be frequency dependent and that, on the average over the upper 1500 km in the mantle, tau sub 2 is approximately 0.07 to 0.16 sec, corresponding to about 1.0 to 2.4 Hz. First order models of tau sub 2-vs-depth are estimated from the ratio of Q(-1) defined by body-wave inversion to the Q(-1) defined by free oscillation inversion. The first order models are tested in the domain. Synthetic seismograms generated for an absorption band rheology are compared to observed seismograms of nuclear explosion sources in both Nevada and Novaya Zemlya. Dissert. Abstr.

N80-23908*# Department of Energy, Mines and Resources, Ottawa (Ontario). Gravity and Geodynamics Div.
INVESTIGATION OF TIDAL DISPLACEMENTS OF THE EARTH'S SURFACE BY LASER RANGING TO GEOS-3
D. R. Bower, J. Halpenny, M. K. Paul, and A. Lambert Apr. 1980 32 p refs
(NASA-CR-156863) Avail: NTIS HC A03/MF A01 CSCL 08F

An analysis of laser ranging data from three stations was carried out in an attempt to measure the geometric Earth tide. Two different approaches to the problem were investigated. The dynamic method computes pass to pass apparent movements in stations height relative to short arcs fitted to several passes of data from the same station by the program GEODYNE. The quasi-geometric method reduces the dependence on unmodelled satellite dynamics to a knowledge of only the radial position of the satellite by considering two station simultaneous ranging at the precise time that the satellite passes through the plane defined by two stations and the center of mass of the Earth. E.D.K.

N80-23909*# Texas Univ. at El Paso. Dept. of Geological Sciences.
OCCURRENCE AND MINERAL CHEMISTRY OF HIGH PRESSURE PHASES, PORTRILLO BASALT, SOUTHCENTRAL NEW MEXICO M.S. Thesis. Final Technical Report, 1 Jun. 1978 - 31 May 1980
J. M. Hoffer and Terri Smith Ortiz 31 May 1980 102 p refs
Original contains color illustrations
(Grant NsG-9062)
(NASA-CR-153192) Avail: NTIS HC A06/MF A01 CSCL 08G

Inclusions of clinopyroxenite, kaersutiteclinopyroxenite, kaersutite-rich inclusions, wehrlite and olivine-clinopyroxenite together with megacrysts of feldspar, kaersutite and spinel are found loose on the flanks of cinder cones, as inclusions within lava flows and within the cores of volcanic bombs in the Quaternary alkali-olivine basalt of the West Potrillo Mountains, southcentral New Mexico. Based on petrological and geochemical evidence the megacysts are interpreted to be phenocrysts which formed at great depth rather that xenocrysts of larger crystal aggregates. These large crystals are believed to have formed as stable phases at high temperature and pressure and have partially reacted with the basalt to produce subhedral to anhedral crystal boundaries. It can be demonstrated that the mafic and ultramafic crystal aggregates were derived from an alkali-basalt source rock generated in the mantle. The inclusions are believed to represent a cumulus body or bodies injected within the lower crust or upper mantle. A.R.H.

N80-23910*# Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
APPLICATION OF LASER RANGING AND VLBI DATA TO A STUDY OF PLATE TECTONIC DRIVING FORCES Final Technical Report, 1 Apr. 1978 - 31 Mar. 1979
Sean C. Solomon 30 May 1980 175 p refs
(Grants NsG-7329; NSF EAR-74-21894; NSF EAR-78-12936)
Avail: NTIS HC A08/MF A01 CSCL 08G

The measurability of changes in plate driving or resistive forces associated with plate boundary earthquakes by laser rangefinding or VLBI is considered with emphasis on those aspects of plate forces that can be characterized by such measurements. Topics covered include: (1) analytic solutions for two dimensional stress diffusion in a plate following earthquake faulting on a finite fault; (2) two dimensional finite-element solutions for the global state of stress at the Earth's surface for possible plate driving forces; and (3) finite-element solutions for three dimensional stress diffusion in a viscoelastic Earth following earthquake faulting. A.R.H.

N80-23911*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SHUTTLE PROGRAM: COMPUTING ATMOSPHERIC SCALE HEIGHT FOR REFRACTION CORRECTIONS
William M. Lear Mar. 1980 281 p Prepared in cooperation

with TRW Systems, Houston, Tex.
(NASA-TM-81059; JSC-16462; Rept-80-FM-16) Avail: NTIS - HC A13/MF A01 CSCL 04A

Methods for computing the atmospheric scale height to determine radio wave refraction were investigated for different atmospheres, and different angles of elevation. Tables of refractivity versus altitude are included. The equations used to compute the refraction corrections are given. It is concluded that very accurate corrections are determined with the assumption of an exponential atmosphere. F.O.S.

N80-23912*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VOLCANIC FEATURES OF HAWAII. A BASIS FOR COMPARISON WITH MARS
M. H. Carr (U.S. Geological Survey, Menlo Park, Calif.) and R. Greeley Washington 1980 216 p refs Original contains color illustrations
(NASA-SP-403; LC-80-600024) Avail: NTIS MF A01; SOD HC $14.00 CSCL 08K

Despite the difference in size Martian and Hawaiian volcanoes have numerous characteristics in common. Specific features such as lava channels, collapsed lava tubes, levees and flow fronts, all very common in Hawaii, are also abundant on the flanks of some of the Martian volcanoes. Striking differences also exist, such as the apparent lack of radial rift zones on some Martian volcanoes and the paucity of cinder and spatter cones. Some of the best photographs of Martian and Hawaiian volcanic features are presented. Descriptive legends are provided for each picture. An overview of the geological processes and structures depicted is included. A.R.H.

N80-23913# RDP, Inc., Waltham, Mass.
DATA PROCESSING SYSTEMS FOR ACCELEROMETER EXPERIMENTS ON AIR FORCE SATELLITES Final Report, 7 Jun. 1976 - 30 Apr. 1979
Robert W. Fioretti, Edwin Barry, and Shirley Cieszka May 1979 37 p refs
(Contract F19628-76-C-0244; AF Proj. 6690)
(AD-A080460; AFGL-TR-79-0237) Avail: NTIS HC A03/MF A01 CSCL 04/1

This report summarizes the data processing required to systematically extract meaningful data from accelerometer experiments flown aboard Air Force satellites. Drag data are extracted from the accelerometer output. These drag measurements are converted to atmospheric density. GRA

N80-23914# Wyoming Univ., Laramie. Dept. of Atmospheric Science.
CONDUCT OF CLOUD SPECTRA MEASUREMENTS Progress Report, 1 Dec. 1978 - 30 Sep. 1979
Gabor Vali, Marcia K. Politovich, Darrel G. Baumgardner, and William A. Cooper Oct. 1979 61 p refs
(Contract F19628-79-C-0029; AF Proj. 6670)
(AD-A081127; AFGL-TR-79-0251; SR-1) Avail: NTIS HC A04/MF A01

The work addressed the following objectives: Compare bench determinations of Axially Scattering Spectrometer Probe (ASSP) and Forward Scattering Spectrometer Probe (FSSP) sample areas with determinations during actual cloud sampling; evaluate the accuracy of the overlap in size range between FSSP and 1D-C probes; evaluate the response of the ASSP and FSSP probes to ice crystals; check the statistical correction schemes used to deal with 1D-C counts in the lowest and highest size categories. The information needed to accomplish these objectives was collected by performing special tests with the probes in question. These tests were conducted, for the most part, at the Elk Mountain Laboratory, during times when the Observatory was enveloped by clouds. Bench and wind-tunnel tests were utilized. In addition, data were derived from aircraft penetrations of clouds, with identical probes as those used at the observatory. GRA

N80-23915# Air Force Geophysics Lab., Hanscom AFB, Mass.
KWAJALEIN REFERENCE ATMOSPHERES, 1979 Interim Scientific Report
Allen E. Oble, Arthur J. Kantor, and C. Russell Philbrick 9 Oct. 1979 109 p refs
(AF Proj. 6670; AF Proj. 6690)
(AD-A081780; AFGL-TR-79-0241; AFGL-ERP-677) Avail: NTIS HC A06/MF A01 CSCL 04/1

Measurements of atmospheric temperature, density, and wind have been used to derive consistent hydrostatic models representative of the atmospheric properties at Kwajalein Atoll, Marshall Islands. A mean annual model and 12 monthly models of thermodynamic properties have been constructed between altitudes of 0 and 120 km, using data available up to 1979. Below an altitude of 60 km, the models are based on a data base that is large enough for the monthly variations to be statistically significant. Above 60 km the significance of the monthly models progressively decreases with altitude because of the small number of high-altitude measurements. The statistical properties of winds have been calculated for altitudes up to 60 km for the midseason months. Although the information used to prepare these models is based primarily on observations made at Kwajalein, some data from other tropical locations have been considered, particularly for such items as the estimates of time and space variations. The Kwajalein Missile Range (KMR) Reference Atmospheres contains information on the following parameters: temperature, pressure, density, speed of sound, dynamic viscosity, wind speed and direction, relative humidity, optical and radar indices of refraction, mean molecular weight, interlevel correlations of temperature, density, and wind, acceleration of gravity, and magnitudes of diurnal and semidiurnal tidal components of temperature, density, and wind. GRA

N80-23916# Naval Research Lab., Washington, D. C. Plasma Physics Div.
THE PHYSICS OF THE PHOTODEPOSITION PHASE OF THE NRL MASTER CODE FOR THE DISTURBED E AND F REGIONS
A. W. Ali 24 Jan. 1980 47 p refs
(AD-A081776; AD-E000376; NRL-MR-4152) Avail: NTIS HC A03/MF A01 CSCL 04/1

The physics of the revised photoionization phase for the NRL Master Code for the Disturbed E and F Region of the ionosphere is presented. The revision utilizes current total and partial photoionization cross sections. GRA

N80-23917# National Academy of Sciences - National Research Council, Washington, D. C. Panel on Gravity Field and Sea Level.
APPLICATIONS OF A DEDICATED GRAVITATIONAL SATELLITE MISSION
1979 64 p refs Presented at the Workshop on a Dedicated Gravitational Satellite Mission, Washington, D.C., 28-30 Nov. 1978
(Contract N00014-76-C-0411)
(AD-A076438) Avail: NTIS HC A04/MF A01 CSCL 08/5

In the late 1960's, it became clear that satellite-determined gravity field data contained a large amount of geophysical and geodetic information. Today, it appears that satellite technology may be capable of resolving the short- and intermediate-wavelength components (100-1000 km) in the Earth's gravity field, thereby contributing even more significantly to the solution of geophysical and geodetic problems and opening up important oceanic applications. A previous NRC report recommended a dedicated gravitational satellite mission (low-altitude satellite or satellites to be launched specifically for the purpose of accurately determining the details of the Earth's gravity field) subject to the analysis of accuracy requirements and feasibilities. This report is the product of a Workshop held in Washington, D.C., from November 28 to November 30, 1978, under the auspices of the NRC's Committee on Geodesy and its Panel on Gravity Field and Sea Level, to ascertain the applications of a dedicated gravitational satellite mission. Topics include: Technology Assessment; Solid-Earth Geophysics--Continents and Oceans; Oceanic Circulation; and Ephemeris and Geodetic Applications. GRA

N80-23918# Battelle Pacific Northwest Labs., Richland, Wash.
SEISMIC DATA CATALOG AND ASSOCIATED GRAPHICAL CAPABILITIES
T. N. Bishop, H. P. Foote, and S. C. Blair Nov. 1979 55 p refs
(Contract EY-76-C-06-1830)

(PNL-2893) Avail: NTIS HC A04/MF A01

An extensive data base of compiled seismic data is described along with useful and unique computer techniques for analysis and display of the data. Software associated with the data base include programs for editing earthquake files, sorting files with respect to time, location, or magnitude, selecting data by use of various parameters and merging files. The desired file may then be listed or displayed graphically. From the data analysis software, an accurate and comprehensive earthquake catalog for the Pacific Northwest was created. Graphic displays can plot two and three dimensional epicenter or hypocenter information. Magnitude and/or depth information can be represented on two-dimensional plots by using color of symbol size. Plots can be produced using a variety of map projections and at a specified scale. The capability allows the use of any desired map as a base map for the display of earthquake data. Dissert. Abstr.

N80-23919# Columbia Univ., Palisades, N.Y. Geological Observatory.

COMPREHENSIVE STUDY OF THE SEISMOTECTONICS OF THE EASTERN ALEUTIAN ARC AND ASSOCIATED VOLCANIC SYSTEMS Annual Progress Report, 1 Mar. 1979 - 29 Feb. 1980

K. H. Jacob, J. N. Davies, and K. R. Sykes 1979 111 p refs (Contract EY-76-S-02-3134)

(COO-3134-20) Avail: NTIS HC A06/MF A01

The modern and historic seismicity of the eastern Aleutian arc was thoroughly researched and shows clear evidence that the Shumagin Islands region of the arc has been ruptured at least partly by previous large or great earthquakes; has recurrence times for large earthquakes between 50 and 115 years; has precently the properites of a seismic gap, i.e., was pot ruptured by a large or great earthquake for a least 76 years; and shows a donut configuraton of modest seismicity including high-stress-drop events around the rim combined evidenc it is concluded that the likelihood for a large or great earthquake to occur within the Shumagin Island gap is high within the next three decades. Stress, stress-drop, and other source parameters of moderate earthquakes in the Shumagin islands gap were alturmined along with similar results for the St. Elaias earthquakes neat the Takatage gap in the eastern Gulf of Alaska. DOE

N80-23920# Los Alamos Scientific Lab., N. Mex.

GRAVITY STUDY OF THE LOS ALAMOS AREA, NEW MEXICO

Laurel M. Williams Nov. 1979 21 p refs (Contract W-7405-eng-36)

(LA-8154-MS) Avail: NTIS HC A02/MF A01

Profiles of gravity readings were observed along two CXC seismic reflection lines recently recorded in Los Alamos County: one in Los Alamos Canyon, the other in Mortandad Canyon and on Sigma Mesa. These data were merged with available gravity data in the Los Alamos area and a density profile across Los Alamos Canyon was modeled to find the proper reduction density. The resulting Bouguer map of the Pajarito Plateau suggests the basement deepens to the northeast. Two dimensional computer modeling of the gravity profiles indicates that subsurface lenses of Tschicoma Formation along the west edge of the Pajarito Plateau may act as an effective basement, obscuring actual basement structures in that area. Thus, an alternative to the graben interpretation of the prominent gravity low in the area is that this low is due to density contrasts within the thick sequences of Quaternary volcanics present. DOE

N80-23921# Preussag A.G., Erdoel und Erdgas, Hannover (West Germany).

DEVELOPMENT OF A THREE-DIMENSIONAL SEISMIC DATA ACQUISITION AND PROCESSING SYSTEM Final Report

Johann Wolfgang Sattlegger Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 115 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-22) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 23,75

Algorithms were developed to allow three dimensional seismic surveys in densely populated areas using a flexible recording geometry. These algorithms are based on ray theory. A computer program is discussed that allows the prediction of effective irregular recording geometries and to compute three dimensional seismic surveys from data obtained from irregular recording geometries. Two test surveys have been carried out. Author (ESA)

N80-23922# Bonn Univ. (West Germany). Inst. fuer Physik.

SOUNDING ROCKET PROGRAM AERONOMY: NEUTRAL COMPOSITION OF THE MESOSPHERE AND LOWER THERMOSPHERE DURING WINTER-ANOMALY CONDITIONS Final Report

Volkmar Friedrich and Ulf vonZahn Bundesmin. fuer Forsch. und Technol. Jun. 1979 84 p refs In GERMAN; ENGLISH summary

(Contract BMFT-WRK-RV-14-B106/73)

(BMFT-FB-W-79-02) Avail: NTIS HC A05/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 17,25

During two rocket flights in January 1976, a mass spectrometer with a helium-cooled ion source measured the number densities of N2, O2, O, Ar, and CO2 at altitudes between 80 km and 117 km. The altitude profiles of these constituents show strong, regular wave-like structures except those for atomic oxygen which seem less regular. Moreover, the absolute number densities of O differed considerably from flight to flight. Possible causes for this difference are discussed. Author (ESA)

N80-23923# Physics Lab. RVO-TNO, The Hague (Netherlands).

THE MEASUREMENT OF THE TRANSMISSION AND THE EMISSION OF THE ATMOSPHERE BY AN INFRARED TELERADIANCE METER

A. C. vanBochove Nov. 1978 86 p refs In DUTCH; ENGLISH summary

(PHL-1978-50; TDCK-71541) Avail: NTIS HC A05/MF A01

Experiments measuring transmissivity, emissivity and contrast transmissivity of the atmosphere at four distances (max 935 m) in 16 different spectral regions are described. An infrared radiance meter was used to perform experiments in the intervals of 3-6 micrometers and 8-4 micrometers. Instrument design, data processing routines, and some results are discussed. Author (ESA)

N80-23924# Prakla-Seismos G.m.b.H., Hannover (West Germany).

FURTHER DEVELOPMENT OF SEISMIC METHODS. THREE-DIMENSIONAL MIGRATION/APPROXIMATION PROCEDURE Final Report

Wolfgang Houba Bonn Bundesmin. fuer Forsch. und Technol. Sep. 1979 141 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-18; ISSN-0340-7608) Avail: NTIS HC A07/MF A01; Fachinformationsznetrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 29,40

Approximate methods for the calculation of geological profiles from seismic measurements along straight lines are discussed. By applying geometrical corrections to the velocities, two dimensional migration methods were found to provide adequate three dimensional images of local subsurface layering, provided the strike does not vary too rapidly in the vicinity of the seismic line. Author (ESA)

N80-23925# Prakla-Seismos G.m.b.H., Hannover (West Germany).

FURTHER DEVELOPMENT OF SEISMIC METHODS: THREE-DIMENSIONAL VELOCITY DETERMINATIONS Final Report

Erich Meixner Bonn Bundesmin. fuer Forsch. und Technol. Sep. 1979 128 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.

(BMFT-FB-T-79-19) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 26,45

A survey of current methods to determine the velocity of seismic waves in geological formations is presented. An iterative computer method is described to calculate seismic interval velocities. A field test example is used to illustrate the method. Author (ESA)

N80-23926# European Space Agency, Paris (France).
ATMOSPHERIC RAYLEIGH SCATTERING IN THE ULTRAVIOLET AND VISIBLE SPECTRAL REGION
Dieter Beran Nov. 1979 43 p refs Transl. into ENGLISH of "Atmosphaerische Rayleigh-Streung im Ultraviol...en und Sichtbaren Spektralkber.", Rept. DLR-Mitt-78-03 DFVLR, Oberpfaffenhofen, West Germany, Oct. 1977 Original report in GERMAN previously announced as N79-30888 Original German report available from DFVLR, Cologne DM 17.90
(ESA-TT-588; DLR-Mitt-78-03) Avail: NTIS HC A03/MF A01

Attenuation by scattering and absorption of solar radiation entering the Earth's atmosphere was studied in order to determine the role of Rayleigh scattering. It is shown that Rayleigh scattering is a function of the solar flux and the scattering cross section. Generally, Rayleigh scattering is single scattering because the small cross section and with it, the low optical depth, do not permit multiple scattering. Rayleigh intensity however depends on direction and is polarized. For the anisotropic air molecules a depolarization factor must be involved. The absorption of solar radiation in the wavelength region under consideration is discussed as being caused by ozone and by molecular oxygen.
Author (ESA)

N80-23927# Oxford Univ. (England). Dept. of Engineering Science.
DYNAMIC FRACTURE STRENGTH OF OIL SHALE AND COAL
W. E. Jahsman (Colorado Univ., Boulder) 1919 30 p refs Sponsored by Colorado Univ.
(OUEL-1295/79) Avail: NTIS HC A03/MF A01

Measurements were carried out on tubular specimens of oil shale and coal using the torsional Kolsky apparatus (split Hopkinson bar) to show that these materials exhibit strain rate dependent fracture strengths. At shear strain rates of 500 s, typical fracture strengths were found to be 80 MPa for oil shale and 12 MPa for coal. A stress redistribution occured in the specimen after initial fracturing along planes perpendicular to the maximum tensile stress. The fracture strength reported for coal, was accompanied by a compressive stress of equal magnitude. The final mode of failure in this case was compressive rather than tensile.
Author (ESA)

N80-23928# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
TELEPHOTOMETRIC STUDY OF BASELINE VISUAL RANGE AT CEDAR MOUNTAIN, UTAH, 21 APRIL TO 16 MAY 1978
Paul A. Allee, William F. Roberts, L. Gwen Lowery, and Gary M. Williams Aug. 1979 46 p refs
(PB80-137383; NOAA-DR-ERL-APCL-4; NOAA-79121209) Avail: NTIS HC A03/MF A01 CSCL 04A

Visual range values derived from telephotometric measurements are presented for four views. Supplementary visual ranges of two distant mountain ranges, the Henry Mountains at 72 miles and the Abajo Mountains at 110 miles, are also given.
GRA

N80-23929# Meteorology Research, Inc., Altadena, Calif.
CHARACTERIZATION OF VISIBILITY-REDUCING AEROSOLS IN THE SOUTHWEST. PROJECT VISTA Final Report, 1-10 Oct. 1977
Edward S. Macias, Donald L. Blumenthal, Jerry A. Anderson, and Bruce K. Cantrell Nov. 1979 68 p refs
(Contract EPA-68-02-2713)
(PB80-139041; MRI-78-IR-1585; EPA-600/7-79-243) Avail: NTIS HC A04/MF A01 CSCL 04A

The atmospheric visibility-reducing aerosol in the Southwest was experimentally characterized with respect to particle size composition, and contribution to light scattering. Measurements were taken within the mixing layer using the instrumented Beechcraft Queen Air aircraft. The aircraft was equipped to measure and record on magnetic tape the light-scattering coefficient, Aitken nuclei count, size distribution, ozone, sulfur dioxide, nitrogen oxides, temperature, dew point, turbulence, pressure (altitude), and navigational parameters. Multistage impactor and size-fractionated filter samples were also collected in order to determine aerosol elemental composition as a function of size. Visual range estimates were obtained by viewing distant landmarks and verified by optical photography.
GRA

N80-23930# Environmental Sciences Research Lab., Research Triangle Park, N.C. Meteorology and Assessment Div.
SPATIAL VARIABILITY OF OZONE AND OTHER POLLUTANTS AT ST. LOUIS, MISSOURI
Thomas R. Karl Oct. 1979 42 p refs
(PB80-132830; EPA-600/4-79-063) Avail: NTIS HC A03/MF A01 CSCL 04A

At a network of 25 aerometric stations, ozone (03) and various other photochemical pollutants, as well as carbon monoxide, were analyzed with respect to their spatial variability. Data were analyzed for April, through October of 1975 and 1976, periods during which high 03 concentrations are common. Topics addressed include the representativeness of pollutant concentrations spatially averaged over some grid scale with respect to the actual concentrations observed in the atmosphere, variations of stationary point measurements in space in and around metropolitan areas, and the number of fixed point measurements necessary to designate the area of highest 03 concentrations.
E.D.K.

N80-23931# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
TELEPHOTOMETRIC STUDY OF BASELINE VISUAL RANGE AT CEDAR MOUNTAIN, UTAH, 19 JANUARY TO 6 MARCH 1979
Gary M. Williams and Paul A. Allee Sep. 1979 50 p refs
(PB80-142227; NOAA-DR-ERL-APCL-6; NOAA-79122601) Avail: NTIS HC A03/MF A01 CSCL 04A

Visual range values derived from telephotometric measurements at Cedar Mountain, Emery County, Utah, from January 19 to March 6, 1979 are presented for the visual ranges of four views and two supplementary views. The air during the winter study was cleaner than it was during the summer study, probably because of the passage of several winter storms. Also, the wind at both lower and upper levels was predominantly from the north and northwest, while summertime flow was from the south, and it is believed that southerly air brings in more light scattering particles than northerly air flow.
GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N80-23932*# Parker (Lee W.), Inc., Concord, Mass.
THUNDERCLOUD ELECTRIFICATION MODELS IN ATMOSPHERIC ELECTRICITY AND METEOROLOGY
Lee W. Parker Mar. 1980 37 p refs
(Contract NAS8-33467)
(NASA-CR-161441) Avail: NTIS HC A03/MF A01 CSCL 04B

A survey is presented of presently-available theoretical models. The models are classified into three main groups: (1) convection models, (2) precipitation models, and (3) general models. The strengths and weaknesses of the models, their dimensionalities and degrees of sophistication, the nature of their inputs and outputs, and the various specific charging mechanisms treated by them, are considered. In results obtained to date, the convection models predict no significant electrification enhancement based on conductivity gradients and convection alone, with the assumed air circulation patterns. Results of the precipitation models show that the initial electrification can occur rapidly and stably through noninductive collision mechanisms involving ice, and breakdown-strength electric fields can relatively easily be achieved subsequently through the collisional-inductive mechanism. A critical difficulty of the collision mechanisms is imprecise knowledge of relaxation times versus contact times, which can easily lead to overestimates of electrification. The general model results tend to support those of the precipitation models in emphasizing the high potential effectiveness of the collisional-inductive mechanism.
F.O.S.

N80-23933*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RATE STATISTICS FOR RADIO NOISE FROM LIGHTNING

D. M. LeVine, R. Meneghini (Maryland Univ., College Park), and S. A. Tretter May 1980 34 p refs
(NASA-TP-1665; G80F5117) Avail: NTIS HC A03/MF A01 CSCL 04B

Radio frequency noise from lightning was measured at several frequencies in the HF - VHF range at the Kennedy Space Center, Florida. The data were examined to determine flashing rate statistics during periods of strong activity from nearby storms. It was found that the time between flashes is modeled reasonably well by a random variable with a lognormal distribution. R.E.S.

N80-23934*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Space Sciences Lab.

ICE CRYSTAL GROWTH IN A DYNAMIC THERMAL DIFFUSION CHAMBER

Vernon W. Keller May 1980 216 p refs
(Grants NSF ATM-75-10935; NSF ATM-77-07995)
(NASA-TP-1651) Avail: NTIS HC A10/MF A01 CSCL 04B

Ice crystals were grown in a supersaturated environment produced by a dynamic thermal diffusion chamber, which employed two horizontal plates separated by a distance of 2.5 cm. Air was circulated between and along the 1.2 m length of the plates past ice crystals which nucleated and grew from a fiber suspended vertically between the two plates. A zoom stereo microscope with a magnification which ranged from 3X to 80X and both 35 mm still photographs and 16 mm time lapse cine films taken through the microscope were used to study the variation of the shape and linear growth rate of ice crystals as a function of the ambient temperature, the ambient supersaturation, and the forced ventilation velocity. The ambient growth conditions were varied over the range of temperature 0 to -40 C, over the range of supersaturation 4% to 50% with respect to ice, and over the range of forced ventilation velocities 0 cm/s to 20 cm/s. E.D.K.

N80-23935*# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.

A TIME VARIABLE MODEL OF EARTH'S ALBEDO Final Report

Fred L. Bartman Mar. 1980 123 p
(Grant NsG-1482)
(NASA-CR-159259) Avail: NTIS HC A06/MF A01 CSCL 04B

A time variable model of Earth's albedo was prepared for use in climate studies and as an aid to the interpretation of satellite Earth radiation budget data. The features of the model include: a 10 deg latitude 10 deg longitude grid for numerical integration, surface albedo specified at 1 month intervals, calculation of zenith angle effect for surface albedo and of the additional effect of the atmosphere on the albedo. Percent cloud cover is specified for 29 different climatological cloud type regions at 8 times of the day for 12 months of the year. Cloud albedos were specified for each of the cloud climatological types. Diurnal and monthly variations of this model are described and results are compared with a model which is based on satellite measurements. A computer program was also written for use in studying the sampling effects in satellite radiation budget measurements. An example of the results of calculations with this program are compared with a previous study of the sampling effects. This program for satellite orbit characteristics is to be combined with the time-variable albedo model for further study of the sampling problem. J.M.S.

N80-23936# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).

NUMERICAL METHODS FOR SOLUTION OF THE SHALLOW-WATER EQUATIONS IN METEOROLOGY Ph.D. Thesis

I. M. Navon Jun. 1979 249 p refs
(CSIR-SR-WISK-10) Avail: NTIS HC A11/MF A01

The system of partial differential equations representing motion in a homogeneous, incompressible and nonviscous fluid in hydrostatic equilibrium with a free surface is dealt with. This system, referred to in meteorology as the shallow water equations system or the primitive barotropic equations system, provides an approximation to large scale weather prediction equations having the same numerical characteristics. Methods for solving this system with improved accuracy or high computational efficiency are studied. Several numerical aspects of this system quasilinear hyperbolic partial differential equations, viewed as a mixed initial boundary value problem, are highlighted. The long term behavior of the shallow water equations systems in the inviscid limit is related to the conservation of a number of integral invariants, in particular conservation of potential enstrophy. The paramount importance of well posed numerical boundary conditions as a prerequisite for the success of limited area integrations of the shallow water equations systems is shown. E.D.K.

N80-23937# Cincinnati Electronics Corp., Ohio.

RADIOMETRIC MEASUREMENTS BY THE MIDAS 3 SYSTEM AT KEY WEST. VOLUME 1: CLOUD BACKGROUNDS Final Report

Al Geiser and Charlie Dippel Sep. 1979 143 p refs
(Contract N60530-79-C-0031; ZF32392002)
(AD-A081052; TR-79-001215) Avail: NTIS HC A07/MF A01 CSCL 17/5

This report describes the test equipment, test procedures, test site and test results for a program to measure the infrared signatures of a representative sample of cloud backgrounds and aircraft at Key West, Florida. Data on various clouds were gathered between April 26 and May 10, 1979, and data on F-4 and F-14 aircraft were gathered between June 4 and June 19, 1979. The MIDAS 3 radiometer was used to measure the infrared signatures of the aircraft during the day and a number of different types of cloud backgrounds at various times of the day and night and at various angles with respect to the sun. The MIDAS 3 System is a small-field scanning radiometer that makes simultaneous measurement of infrared sources in the 3-5 and 8-13 micrometer spectral regions. The 3-5 spectral region is further sub-divided into smaller spectral bands by inserting various spectral filters in front of the 3-5 detector.GRA

N80-23938# Woods Hole Oceanographic Institution, Mass.

ATLANTIS 2 CRUISE 102 MOORED AND SHIPBOARD SURFACE METEOROLOGICAL MEASUREMENTS DURING JASIN 1978

Melbourne G. Briscoe, Carol A. Mills, Richard F. Payne, and Kenneth R. Peal Dec. 1979 93 p refs
(Contract N00014-76-C-0197; Grants NSF OCE-77-25803; NSF OCE-76-80174; NR Proj. 083-400)
(AD-A080732; WHOI-79-43) Avail: NTIS HC A05/MF A01 CSCL 04/2

During cruise 102 of the R/V Atlantis-II in the Joint Air-Sea Interaction Project (JASIN), surface meteorological data were gathered by Woods Hole Oceanographic Institution personnel from two moored buoys and from the ship. One buoy (JASIN W2/WHOI 651) carried a Vector Averaging Wind Recordor (VAWR) and a Vector Measuring Wind Recorder (VMWR); these instruments provided 18 days of intercomparison data and 38 days of meteorological data from 30 July to 6 September 1978. The other buoy (JASIN H2) carried a VMWR and gave 25 total days of data from 16 July to 10 August, and from 26 August to 1 September. A PET computer, hardwired to sensors positioned on the ship, displayed data that were logged during both legs of the cruise. Manual data were gathered by the science watches. This report describes the PET system, and displays and compares all the data. VAWR hourly meteorological data are listed for the 38 day period. Scientific interpretation of these data, such as calculations of heat fluxes, will be published separately. GRA

N80-23939# Pacific Missile Test Center, Point Mugu, Calif. Geophysics Div.

DIURNAL VARIATIONS OF COASTAL STRATUS

Thomas Frederick Lee Jun. 1979 60 p refs
(AD-A080951; PMTC-TP-80-02) Avail: NTIS HC A04/MF A01 CSCL 04/2

Diurnal dissipation of stratus over and off the southern California and Baja California coasts during two months of July is measured using GOES visual imagery. Morning inland penetration of the eastern stratus margin is favored in coastal valleys and restricted by hills. Afternoon dissipation of the margin away from land usually occurs the length of the coast, with the breadth of clearing being large off southern California, but limited

both north of Point Arguello and south of San Diego. Decreased frequency of stratus ceilings in the southern California bight seems to be related to subsidence in the lee of the Santa Ynez Mountains to the north. With 850 mb wind flow from north and east (340-159 deg), which favors lee subsidence, this region was more often stratus free than for flow from south and west (160-339 deg). GRA

N80-23940# Calspan Advanced Technology Center, Buffalo, N.Y.

DEFORMATION OF THE MARINE INVERSION AND THE DEVELOPMENT OF MARINE FOG AND STRATUS RESULTING FROM WARM WATER PATCHES, NUMERICAL MODELING AND VERIFICATION WITH SATELLITE IMAGERY

C. William Rogers and James T. Hanley Nov. 1979 32 p refs
(Contract N00014-79-C-0459)
(AD-A081089; CALSPAN-6512-M-1) Avail: NTIS HC A03/MF A01 CSCL 04/2

The results presented here represent the initial application of a numerical model, designed originally to study snow storms occurring downwind of a warm lake, to stratus/fog systems occurring downwind of the warm water patches in the ocean. Major differences between the two applications include: (1) an order of magnitude difference in inversion heights, with the base of the marine layer inversion being typically a few hundred meters above the surface and (2) air-water temperature differences of a couple of degrees centigrade over the ocean compared to 5-15 C over the lake. Using observed sea surface temperature patterns and meteorological conditions as input, Lavoie model simulations reproduce quite well the location and orientation of the major axis of the cloud field and predict a maximum in liquid water content near the bright core of the observed cloud. The location of the seaward edge of the cloud pattern is reproduced but with somewhat less skill than for the other cloud field features. This limited feasibility study has demonstrated that a significant potential exists for developing a stratus cloud-fog forecasting method based on a suitably modified version of the Lavoie model which uses satellite imagery as the basic input. GRA

N80-23941# Control Data Corp., Minneapolis, Minn.

STATISTICAL RETRIEVAL OF TEMPERATURES FROM SCR-8, AT 10 TO 0.4 MB Final Report, 1 Jan. 1978 - 31 Jan. 1979

D. N. Hovland and R. W. Wilcox Mar. 1979 46 p refs
(Contract F49620-78-C-0036; AF Proj. 2310)
(AD-A077359; AFOSR-79-1091TR) Avail: NTIS HC A03/MF A01 CSCL 04/2

The purpose of this first phase of a study on the morphology of planetary waves was to estimate global temperatures for the upper stratosphere and lower mesophere from the radiances of the SCR-8 experiment on Nimbus 5. This has been successfully achieved using a regression of the radiances on meteorological rocket data. In general, the accuracy of the retrieved temperatures, i.e., standard deviation of the error, varies from about 3 K at 10 mb to about 5.5 K at 0.4 mb as compared to meteorological rocket values. Layer mean temperatures are about one-half degree more accurate than temperatures at the bordering levels. Details of the procedure, which included extensive prior preparation of the radiances, are given here. Global temperatures at 10, 5, 2, 1 and 0.4 mb along the orbit, and the mean temperatures (thicknesses) between the levels, are now ready to apply to the next phase of this study, which will obtain heights of those surfaces at latitude-longitude gridpoints. The planetary waves will be computed from these gridpoint values. GRA

N80-23942# Purdue Univ., Lafayette, Ind. Dept. of Statistics.

SOME STATISTICAL TECHNIQUES FOR CLIMATOLOGICAL DATA

Shanti S. Gupta and S. Panchapakesan Jan. 1980 14 p refs
Prepared in cooperation with Univ. of Southern Illinois, Carbondale
(Contract N00014-75-C-0455)
(AD-A081490;) Avail: NTIS HC A02/MF A01 CSCL 12/1

Statistical methods are increasingly being applied in the analysis of climatological data. A brief introduction to subset selection approach in multiple decision theory is given to illustrate the potential applications in climatology. GRA

N80-23943# British Columbia Univ., Vancouver. Inst. of Oceanography.

THE TURBULENT FLUXES OF MOMENTUM AND SENSIBLE HEAT OVER THE OPEN SEA DURING MODERATE TO STRONG WINDS Ph.D. Thesis

William George Large Aug. 1979 195 p refs
(Contracts N00014-76-C-0446; N00014-66-C-0447; NR Proj. 083-207)
(AD-A081392) Avail: NTIS HC A09/MF A01 CSCL 04/2

Two systems for remote measurements of the air-sea fluxes of momentum, sensible heat and moisture during moderate to strong winds are described. One employs the dissipation method and the other the Reynolds flux or eddy correlation method. A modified Gill propeller-vane anemometer is the velocity sensor and a method of resolving the vertical velocity component that accounts for the propeller's non-cosine behavior and avoids its non-linear operating region is derived. The dynamic responses of the sensors are found from measurements in the actual turbulent conditions of the flux measurements. The results of an experiment on the Bedford tower, a stable platform moored in 59m of water 10 km offshore, are presented. Spectra, cospectra, turbulence statistics and transfer coefficients are calculated from the Reynolds flux velocity and temperature data and found to be comparable to previously reported values. Simultaneous dissipation and Reynolds flux estimates of both the momentum and sensible heat fluxes in up to 20 m/s winds are shown to be in excellent agreement. Also presented are the results of a second experiment where the systems were deployed on the weathership CCGS Quadra. A comparison of ship and tower drag coefficients from the dissipation system, demonstrates that the Bedford tower is essentially an open ocean site. GRA

N80-23944# Texas A&M Univ., College Station. Dept. of Meteorology.

A STUDY OF THE VARIABILITY OF THUNDERSTORM ELECTRICAL EVENTS BASED ON VERY-LOW-FREQUENCY ELECTROMAGNETIC DATA Ph.D. Thesis. Final Report, 1 Oct. 1978 - 30 Sep. 1979

William Burns Freeman, Jr. Aug. 1979 183 p refs
(Grant AF-AFOSR-0003-79; AF Proj. 2310)
(AD-A081305; AFOSR-80-0115TR) Avail: NTIS HC A09/MF A01 CSCL 04/1

Sferics counts were used to estimate the incidence of lightning discharges; study the relationship of lightning-flash density to thunderstorm days; and explore the variability to cloud-to-ground discharges. Areal and global discharge incidence estimates were generated from sferics, yielding a global estimate of 1.3 times ten to the minus 5th power /Sq km/s. Gridded monthly values are given for much of the Eastern Hemisphere. The Southern Hemisphere tropics were found to have a average incidence of discharge than the Northern Hemisphere tropics. The linear regression relationship between flash density and thunder storm days indicated lower estimates of flash density when based on data stratifications compared to previous studies. Selected data from the Eastern Hemisphere were studied by linear regression techniques for causes of large-scale variability of cloud-to-ground discharges. In order of importance the regressors were the height of freezing level, the planetary geomagnetic index, a parameterization of the height of the freezing level, precipitable water in 1000-850 mb layer, the dew-point depression at 850 mb, the K index of stability, and the departure of the H-component of the magnetic force vector from its mean. GRA

N80-23945# Colorado State Univ., Fort Collins. Solar Energy Applications Lab.

EXPERIMENTAL INVESTIGATION OF AN INEXPENSIVE SKY TEMPERATURE MEASURING DEVICE Final Report, 1 Jun. 1977 - 30 Jun. 1979

S. Karaki and P. Brothers Aug. 1979 23 p refs
(Contract EG-77-S-02-4522)
(COO-4522-1) Avail: NTIS HC A02/MF A01

Efforts were made to develop a simple approach for determining clear sky temperature from ground air temperature and absolute humidity and to develop an inexpensive device for direct measurement of sky temperature. The analytical approach

taken was similar to that developed by Bliss. A model to estimate sky temperature to acceptable accuracy, however, was not achieved. A simple device to measure sky temperature was designed and tested but development efforts within the means of the project were unsuccessful. It was concluded that a device that could include measurement or knowledge of the convective heat transfer coefficient rather than control or elimination of it would be an alternative approach in the development of a sky temperature measurement device. DOE

N80-23946# Brookhaven National Lab., Upton, N. Y.
RECOMMENDED CHANGES IN METEOROLOGICAL MEASUREMENT AND PREDICTION METHODS FOR COASTAL SITES
Gilbert S. Raynor, Paul Michael, and S. SethuRaman 1980 5 p refs Presented at the 2nd Conf. on Coastal Meteorology (AMS), Los Angeles, 31 Jan. - 1 Feb. 1980
(Contract EY-76-C-02-0016)
(BNL-26840; CONF-800107-2) Avail: NTIS HC A02/MF A01

Meteorological measurement programs and atmospheric transport and diffusion prediction models for nuclear power plants were evaluated to determine their adequacy for plants located in coastal zones for changes to improve current procedures. Recommendations for changes to improve current procedures, based on an extensive literature review and on studies of coastal meteorology and diffusion are discussed. The following areas were highlighted in the evaluation: coastal internal boundary layers; tower location; instrument heights; atmospheric stability classification; plume meander and diffusion calculations. DOE

N80-23947# Battelle Pacific Northwest Labs., Richland, Wash.
WIND CHARACTERISTICS FOR AGRICULTURAL WIND ENERGY APPLICATIONS
David S. Renne Jan. 1979 5 p refs Presented at the 14th Conf. on Agr. and Forest Meteorology, Minneapolis, 24 Apr. 1979
(Contract EY-76-C-06-1830)
(PNL-SA-7270; CONF-7904120-1) Avail: NTIS HC A02/MF A01

The development of economically viable wind energy conversion systems (WECS) is discussed. The use of the WECS in farm and rural applications is examined. Potential applications for WECS include irrigation pumping, residential heat, control of livestock environment, crop drying, and water heating and pumping. A map outlining the wind energy resource in the United States is presented at the various wind characteristics important to WECS are delineated. A.W.H.

N80-23948# Hawaii Univ., Honolulu. Dept. of Meteorology.
HAWAII WIND POWER SURVEY: FIXED STATION DATA
C. S. Ramage, N. E. Oshiro, and S. T. Yokogawa Dec. 1979 66 p refs Sponsored in part by Kauai County Council, Maui County, Hawaii
(Grant EG-77-G-03-1617)
(UHMET-79-15) Avail: NTIS HC A04/MF A01

Winds were measured at windy locations in the Hawaiian Islands for periods ranging from 9 to 40 months. Careful calibration and comparison with the nearest airport measurements allow for correction of elimination of bad data. The differences were sufficiently small to justify computing speed and power density, and diurnal variations of wind speed and power density for each station. A significant area on each island possesses high annual wind power (power density at 50 m (164) AGL exceeding 400 W/sqm). The monitoring of the strong wind area of northwest Molokai, until now sampled only during a mobile survey, is outlined. Plans include making detailed measurements of the turbulence characteristics and the vertical profile of the wind in each of the major strong wind areas. DOE

N80-23949# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
FILTERING METEOROLOGICAL FLIGHT DATA
Charles Edward Wallington Jun. 1979 104 p refs
(DFVLR-Mitt-79-19) Avail: NTIS HC A06/MF A01; DFVLR, Cologne DM 17,50

Filtering techniques are discussed which can be used to smooth out short period noise and to attempt to extract data on intermediate scales. Difficulties and pitfalls of designing and applying filters are described and the steps to be taken in choosing filter types and parameters are listed. Author (ESA)

N80-23950# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
PROJECT SEVERE ENVIRONMENTAL STORMS AND MESOSCALE EXPERIMENT Summary Report
Ronnie L. Alberty, Donald W. Burgess, Carl E. Hane, and John F. Weaver Aug. 1979 278 p
(PB80-119902; NOAA-79102303) Avail: NTIS HC A13/MF A01 CSCL 04B

Various aspects of smaller scale circulations were measured and observed and are discussed. Existing observational resources which provided the necessary data base for improved analytical, conceptual, and numerical efforts to understand and project mesoscale convection are described. The severe thunderstorm problem along with attendant important circulations on adjacent spatial scales are discussed. The meteorological settings for various data collection efforts are examined. G.R.A.

N80-23951# National Environmental Satellite Service, Washington, D. C.
ENVIRONMENTAL SATELLITE IMAGERY, APRIL 1979
Oct. 1979 100 p
(PB80-130214; NOAA-79113001) Avail: NTIS HC A05/MF A01 CSCL 04B

Photographs from the TIROS N satellite which show cloud cover for the northern and southern hemispheres during the April of 1979 are presented. The TIROS N instrument system, including the advanced very high resolution radiometer, the TIROS operational vertical sounder, the data collection system, and the space environment monitor, is discussed. A.W.H.

N80-23952# Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Atmospheric Physics.
DETECTION OF CLEAR-AIR TURBULENCE BY WATER VAPOUR EMISSION VARIATIONS: TRANSMITTANCES AND WEIGHTING FUNCTIONS Final Report
Aug. 1979 32 p
(Grant NOAA-04-78-1301-20)
(PB80-130339; NOAA-79110204) Avail: NTIS HC A03/MF A01 CSCL 04B

A model of a water vapor disturbance (assumed to be caused by clear air turbulence) in the stratosphere or upper troposphere was used to investigate the changes in emission along a slant path which an aircraft detector would view when encountering such a disturbance ahead of the aircraft. Transmittances for the 260/cm to 500/cm spectral region were calculated along slant paths assuming detector viewing angles above the horizon of from 0.5 degrees to 10 degrees. Weighting functions in terms of the transmissance rate of change with eater path and the radiance rate of change with time were investigated for water vapor increases in a disturbance of 10 ppm. The predicted radiance changes were compred with known radiometer sensitivities and with actual observed changes. GRA

N80-23953# National Technical Information Service, Springfield, Va.
CLIMATIC CHANGES FROM INCREASED ATMOSPHERIC CARBON DIOXIDE. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1970 - Jan. 1980
George W. Reimherr Feb. 1980 46 p
(PB80-805427) Avail: NTIS HC $30.00/MF $30.00 CSCL 04B

The cited reports amine the relationship between climatic changes and an increase in atmospheric carbon dioxide. Topics considered include the Greenhouse effect, global climatic models, and climatic effects, from increased combustion of fossil fuels. Thirty nine abstracts are presented. GRA

N80-23954# National Weather Service, Wallops Island, Va. Techniques Development Lab.
COMPARISON AND VERIFICATION OF DYNAMICAL AND STATISTICAL LAKE ERIE STORM SURGE FORECASTS
William S. Richardson and David J. Schwab (NOAA, Ann Arbor,

Mich.) Nov. 1979 25 p refs
(PB80-137797; NOAA-TM-NWS-TDL-69; NOAA-79121201)
Avail: NTIS HC A02/MF A01 CSCL 04B

Lake Erie storm surge forecasts produced by a dynamical and a statistical method for several months in 1977 and 1978 are compared. The dynamical method yields much better forecasts at Buffalo and slightly better forecasts at Toledo. GRA

N80-23955# National Oceanographic Data Center, Washington, D. C.
REPORT OF THE CLIMATE DATA MANAGEMENT WORKSHOP
1979 311 p refs Workshop held at Harpers Ferry, West Va., 8-11 May 1979
(PB80-128226; NOAA-79112101) Avail: NTIS HC A14/MF A01 CSCL 04B

The development of an integrated inventory of climate data is discussed. The status of the various types of climate data are assessed in relation to their requirements. The topics addressed included: hydrology, precipitation, snow and ice; ocean data; atmospheric data; climate inventory; and land use. A.W.H.

N80-23519*# Santa Barbara Research Center, Goleta, Calif.
DESIGN OF AN ATMOSPHERIC SOUNDING RADIOMETER FOR THE GOES METEOROLOGICAL SATELLITE SYSTEM
Robert G. Jensen *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 289-301 (For primary document see N80-23495 14-31)
(Contracts NAS5-21139; NAS5-20769)
Avail: NTIS HC A15/MF A01 CSCL 04B

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N80-23956*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REMOTE SENSING AND PROBLEMS OF THE HYDROSPHERE. A FOCUS FOR FUTURE RESEARCH
Edward D. Goldberg, ed. (Scripps Inst. of Oceanography, La Jolla, Calif.) Apr. 1980 35 p refs Meeting held at New Orleans, 9-11 May 1979
(NASA-CP-2132; L-13845) Avail: NTIS HC A03/MF A01 CSCL 08C

The underly problems of water quality which are addressable with remote sensors are considered. The chemical, biological, geological, and physical dynamics of natural ecosystems are examined. For individual titles, see N80-23957 through N80-23960.

N80-23957*# Manhattan Coll., New York.
BIOPROCESSES
Dominic M. DiToro, Richard L. Iverson (Florida State Univ., Tallahassee), and James J. McCarthy (Harvard Univ., Cambridge) *In* NASA. Langley Res. Center Remote Sensing and Probl. of the Hydrosphere Apr. 1980 p 3-8 (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08A

The application of remote sensing techniques to the study of eutrophication in natural waters and the location and characterization of fronts is considered. The specific problem to be studied is examined along with the feasibility and capability of remote sensing techniques for each application. J.M.S.

N80-23958*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GLOBAL GEOCHEMICAL PROBLEMS
Robert C. Harriss *In its* Remote Sensing and Probl. of the Hydrosphere Apr. 1980 p 9-11 (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08C

Application of remote sensing techniques to the solution of geochemical problems is considered with emphasis on the 'carbon-cycle'. The problem of carbon dioxide sinks and the areal extent of coral reefs are treated. In order to assess the problems cited it is suggested that remote sensing techniques be utilized to: (1)monitor globally the carbonate and bicarbonate concentrations in surface waters of the world ocean; (2)monitor the freshwate and oceanic biomass and associated dissolved organic carbon; (3) inventory the coral reef areas and types and the associated oceanographic climatic conditions; and (4)measure the heavy metal fluxes from forested and vegetated areas, from volcanos, from different types of crustal rocks, from soils, and from sea surfaces. J.M.S.

N80-23959*# North Carolina Univ., Chapel Hill.
GAS AND AEROSOL FLUXES
Christopher S. Martens *In* NASA. Langley Res. Center Remote Sensing and Probl. of the Hydrosphere Apr. 1980 p 12-22 refs (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08J

The development of remote sensing techniques to address the global need for accurate distribution and flux determinations of both man made and natural materials which affect the chemical composition of the atmosphere, the heat budget of the Earth, and the depletion, of stratospheric ozone is considered. Specifically, trace gas fluxes, sea salt aerosol production, and the effect of sea surface microlayer on gas and aerosol fluxes are examined. Volatile sulfur, carbon, nitrogen, and halocarbon compounds are discussed including a statement of the problem associated with each compound or group of compounds, a brief summary of current understanding, and suggestions for needed research. J.M.S.

N80-23960*# State Univ. of New York, Stony Brook.
COASTAL SEDIMENTATION
Jerry R. Schubel *In* NASA. Langley Res. Center Remote Sensing and Probl. of the Hydrosphere Apr. 1980 p 23-29 refs (For primary document see N80-23956 14-48)
Avail: NTIS HC A03/MF A01 CSCL 08J

Several important coastal sedimentation problems are identified. Application of existing or anticipated remote sensing techniques to examine these problems is considered. Specifically, coastal fine particle sediment systems, floods and hy hurricanes and sedimentation f of coastal systems, routes and rates of sediment transport on continental shelves, and dredging and dredged material disposal are discussed. J.M.S.

N80-23961# Phoenix Corp., McLean, Va.
VALIDATION OF OCEAN TIDE MODELS FROM SATELLITE ALTIMETRY Interim Progress Report, May - Oct. 1978
R. D. Brown 15 Oct. 1979 36 p refs
(Contract N00014-79-C-0409)
(AD-A078294) Avail: NTIS HC A03/MF A01 CSCL 08/3

Tides in the deep ocean can be determined directly from satellite altimetry, completely independent of assumptions about earth tides, bottom topography and coastal geometry and thus free of the uncertainties which plague numerical tide models. Existing tide models differ by 1 meter or more in the value of sea surface height in the deep ocean at a given place and time. This uncertainty is a formidable obstacle to determination of a precise marine geoids from satellite altimetry. By harmonic analysis of the temporal changes in altimeter measurements at satellite subtrack crossover points, it is possible to solve for the amplitude and phase of harmonic tidal components. However, care must be exercised in the removal of satellite orbit errors, and in the selection of crossovers for sufficient observability of the phase angle of the harmonic tidal component. Preliminary tidal solutions in the Gulf of Alaska using the relatively sparse GEOS-3 altimeter data distribution show generally good agreement (20 cm in amplitude and 25 degrees in phase) with deep ocean bottom pressure gauge measurements and establish the feasibility of this technique. SEASAT altimeter data yields a much greater density of crossovers (400 plus per 1/2 deg by 1/2 deg area), making possible much better separation of individual harmonic components within the semi-diurnal and diurnal families. GRA

N80-23962# Dynalysis of Princeton, N.J.
WHOLE BASIN MODEL OF THE GULF OF MEXICO
A. F. Blumberg and G. L. Mellor (Princeton Univ.) 1979 11 p refs Presented at the 6th OTEC Conf., Washington, D.C., 19 Jun. 1979
(Contract ET-78-C-02-5028)
(CONF-790631-12) Avail: NTIS HC A02/MF A01

An ocean model which is advanced beyond the current state of the art was developed. Characteristics of the model include: a second moment turbulence closure model capable of accurate prediction of small scale turbulent mixing and derivative ocean features such as mixed layer temperature and depth; an algorithm which calculates the external (tidal) mode separately from the internal mode; a sigma coordinate system with 20 levels in the vertical independent of depth; and coding deliberately designed for modern array processing computers. Some preliminary tests of the model as applied to the Gulf of Mexico are described. DOE

N80-23963# Rheinische Braunkohlenwerke A.G., Cologne (West Germany). Abt. Rohstoffe.
SOIL MECHANICAL TESTS ON PACIFIC DEEP SEA SEDIMENTS Final Report
Olaf Lettau Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1978 34 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-78-02) Avail: NTIS HC A03/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 7.35

The results of soil mechanical studies of the Pacific Ocean flow are described. The properties of deep sea sediments were studied in order to design deep sea collecting machines for managanese modules. Sediment depth profiles of the vane shear strength are presented graphically. Author (ESA)

N80-23964# California Univ., San Diego, La Jolla. Inst. of Marine Resources.
CALIFORNIA SEA GRANT COLLEGE PROGRAM: AN OVERVIEW 1977 - 1978
1979 29 p
(Grant NOAA-04-7-158-44121)
(PB80-127988; IMR-79-102; SG-68; NOAA-79112109) Avail: NTIS HC A03/MF A01 CSCL 05I

An overview of the 1977-78 California Sea Grant Program is presented. The report addresses three themes that are among the foremost issues facing society today; ecology, technology, and cooperation. The scientific investigations reported range from the broadly fundamental to the sharply practical. The educational and advisory efforts described are critical to developing a common understanding of the potential of the ocean and the implications of developing that potential. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N80-23965# Martin Marietta Labs., Baltimore, Md.
PHOTOCHEMISTRY AND ENZYMOLOGY OF PHOTOSYNTHESIS Progress Report
Richard Radmer 30 Jul. 1979 100 p refs
(Contract EY-76-C-02-3326)
(COO-3326-82) Avail: NTIS HC A05/MF A01

Three basic problems are addressed: (1) the effect of different preparative procedures on various photosynthetic reactions, with particular emphasis on photosystem II reactions in corn bundle sheath chloroplasts; (2) the development and testing of photosystem II assays; and (3) studies of the stoichiometry of electron carriers in bundle sheath chloroplasts, and whether cyclic phosphorylation could be a major pathway in this tissue. The instruments and techniques to be used in investigating the problems are discussed. DOE

N80-23966# California Univ., Berkeley. Lawrence Berkeley Lab. Chemical Biodynamics Div.
STUDIES OF PHOTOSYNTHETIC MEMBRANES USING CHLOROPHYLL FLUORESCENCE LIFETIMES Ph.D. Thesis
Grace Toy Brewington Sep. 1979 189 p refs
(Contract W-7405-eng-48)
(LBL-9795) Avail: NTIS HC A09/MF A01

Using a single photon counting system with spark discharge excitation, the in vivo flouroescence kinetics in samples that had been treated with DCMU/NH2OH, ferricyanide, dithionite, background actinic illumination, and different cations in the buffer were investigated. From the studies it was concluded that: (1) fluorescence at the F sub o level does not arise from pigments that are not connected to the PS II reaction center; (2) a puddle model is inadequate to explain these data; (3) these data can be accommodated by a model in which tau sub 1 arises from the chlorophyll a of the chlorophyll a/b light harvesting complexes, and tau sub 2 arises from chlorophylls more directly affected by the PS II reaction center, such as the PS II chlorophyll a antenna; and (4) the fluorescence lifetime data for samples treated with sodium or magnesium ion are consistent with the models of spillover and alpha change. The fluorescence lifetime behavior in chloroplasts as a function of the redox state of the primary acceptor of PS II was also studied. DOE

N80-23967# Unilever Research, Vlaardingen (Netherlands).
EFFECT OF HYDROGEN CHLORIDE ON THE MORPHOLOGY OF BACILLUS SUBTILIS SPORES
H. L. M. Lelieveld 1979 10 p refs Submitted for publication
Avail: NTIS HC A02/MF A01

Gaseous hydrogen chloride, in the presence of a minute amount of water vapor, rapidly inactivates bacterial spores. Scanning electron microscopy showed that the treatment caused spores of Bacillus subtilis to collapse. Based on modern theories of spore structure and resistance, it is likely that hydrogen chloride inactivates, and causes the collapse of spores by breaking disulphide bonds in coat protein and neutralizing, by protonation, peptidoglycan carboxyl groups in the underlying cortex. Author (ESA)

N80-23968# Unilever Research, Vlaardingen (Netherlands).
STERILIZATION BY MEANS OF HYDROGEN CHLORIDE: INFLUENCE OF PROCESS PARAMETERS ON THE BIOCIDAL ACTIVITY
H. L. M. Lelieveld and H. M. J. vanEijk 1979 40 p refs Submitted for publication
Avail: NTIS HC A03/MF A01

At ambient temperatures, hydrogen chloride is a strong bactericide. At a partial hydrogen chloride pressure of 30 mmHg, the number of spore bearing colony forming units present in straw-dust particles of 0-32 micrometers was reduced by a factor of more than 50,000 within 60 sec. Naked spores of Bacillus subtilis were reduced in viability by a factor of 100,000 within only 10 sec. Viability of vegetative cells of various kinds of bacteria was reduced by a factor of more than 10 to the 7th power within 10 sec. The manner of administration of the gas influenced the sterilization and must be adapted to the geometry of the surfaces to be sterilized. Increases in treatment time and concentration of hydrogen chloride enhanced the sterilizing effect to a lesser extent when large dust particles were involved. The partial water vapor pressure did not influence the sterilization between 0.3 and 6 mmHg. An increase in temperature decreased the sterilizing effect. Author (ESA)

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N80-23969* National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
PULSE TRANSDUCER WITH ARTIFACT SIGNAL ATTENUATOR Patent
Wilbur H. Cash, Jr. (Martin Marietta Aerospace, Denver) and John T. Polhemus, inventors (to NASA) (Martin Marietta Aerospace, Denver) Issued 22 Apr. 1980 4 p Filed 26 Jul. 1978 Supersedes N78-28339 (16 - 19, p 2520) Sponsored by NASA
(NASA-Case-FRC-11012-1; US-Patent-4,198,988; US-Patent-Appl-SN-928137; US-Patent-Class-128-666; US-Patent-Class-128-690) Avail: US Patent and Trademark Office CSCL 06B

An artifact signal attenuator for a pulse rate sensor is described. The circuit for attenuating background noise signals is connected with a pulse rate transducer which has a light source and a detector for light reflected from blood vessels of a living body. The heart signal provided consists of a modulated

dc signal voltage indicative of pulse rate. The artifact signal resulting from light reflected from the skin of the body comprises both a constant dc signal voltage and a modulated dc signal voltage. The amplitude of the artifact signal is greater and the frequency less than that of the heart signal. The signal attenuator circuit includes an operational amplifier for canceling the artifact signal from the output signal of the transducer and has the capability of meeting packaging requirements for wrist-watch-size packages. A.R.H.

N80-23970 University of Northern Colorado, Greeley.
TIME FOR RECOVERY FROM SUCCESSIVE BOUTS OF EXERCISE AS MEASURED BY CHANGES IN THE ANAEROBIC THRESHOLD: A COMPARISON OF RECOVERY INTERVALS OF 24 AND 48 HOURS Ph.D. Thesis
Jeffrey Mark Broida 1979 194 p
Avail: Univ. Microfilms Order No. 8010467

The time course for recovery from successive bouts of prolonged and fatiguing exercise was examined to determine if a measure of anaerobic threshold (AT) could be used to differentiate the degree of recovery from exercise frequencies of 3.5 and 7 days per week in which the recovery times were 48 hours and 24 hours respectively. It was concluded that the AT level will decrease if an individual exercises too often with insufficient time for recovery to be complete. Twenty-four hours of recovery time is not sufficient during the first few weeks of prolonged exercise training if the activity consists of running for 45 minutes. Twenty-four hours of recovery time may be sufficient for the 'trained' individual whose physiological mechanisms have had time to adapt. This adaptation period may take from 3 to 6 weeks. Training at the AT either 3.5 or 7 days per week for 45 minutes each session will not increase the AT in a period of 9 weeks. The results of this study indicated that the AT holds potential for being a sensitive indicator of underlying physiological changes resulting from exercise. Dissert. Abstr.

N80-23971 Wayne State Univ., Detroit, Mich.
CORONARY PLEXUS IN MAN AND MONKEY Ph.D. Thesis
Arthur James Jackson 1979 116 p
Avail: Univ. Microfilms Order No. 8010147

The distribution of autonomic nerve fibers in relation to the coronary arteries and their branches is examined, and axon terminals in the region of arterioles and capillaries are identified. The left and right coronary plexuses were studied, macroscopically, in seven human hearts and three monkey (Macaca Mulatta) hearts with the aid of a binocular dissecting microscope. In addition, the coronary arteries and their branches with the adjacent myocardium, from a stump-tail (Macaca Arctoides) and Rhesus monkey, were studied by transmission electron microscopy with and without the 'false neurotransmitter, 5-hydroxydopamine. The results suggest that if the coronary arteries are subject to autonomic control, it may be at the level of the capillary bed. Dissert. Abstr.

N80-23972 Pennsylvania State Univ., University Park.
RELATIONSHIP BETWEEN URINARY 3-METHYLHISTIDINE EXCRETION AND COMPONENTS OF BODY COMPOSITION IN MAN Ph.D. Thesis
Henry Charles Lukaski 1979 124 p
Avail: Univ. Microfilms Order No. 8010079

The relationship between urinary 3-methylhistidine (3-Mehis) excretion and components of body composition was studied in 14 men (mean age 25.2 years). Based on energy and protein intakes derived from seven day dietary records, the subjects were given a meat diet for the first four days and a meat-free diet for the next seven days. Body weight was measured daily and all urine was collected daily and analyzed for creatinine, urea nitrogen, and 3-Mehis. Densitometry and skinfold measurements were performed and total body potassium (TBK), nitrogen (TBN), and water (TBW) were determined. During the meat-free diet, urea nitrogen output was constant, indicating no increase in protein catabolism, creatinine excretion was variable, and 3-Mehis reached its lowest level, endogenous output, on day three. 3-Mehis was more closely related to muscle weight ($r = 0.91$; p less than 0.001) calculated from measurements of TBK and TBN than to free fat ($r = 0.81$; p less than 0.001) calculated from densitometry. It is concluded that because endogenous 3-Mehis is closely and significantly related to muscle weight in man, it can be used to study skeletal muscle protein degradation provided that the necessary dietary restrictions are observed. Dissert. Abstr.

N80-23973*# National Aeronautics and Space Administration, Washington, D. C.
IDEAS OF I. M. SECHENOV IN AVIATION AND SPACE MEDICINE
Oleg Georgiyevich Gazenko and Yevgeniy Aleksandrovich Kovalenko Jan. 1980 18 p refs Transl. into ENGLISH from Priroda (USSR), no. 9, 1979 p 30-37 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75976) Avail: NTIS HC A02/MF A01 CSCL 06E

The contributions I. M. Sechenov (19th century) made to modern physiology are described, including his studies on gases in the blood (02 and C02), and how these studies were the basic building blocks of current efforts in aviation and space medicine. Sechenov also studied hypokinesia, which is becoming important in long duration space flights. R.E.S.

N80-23974*# National Aeronautics and Space Administration, Washington, D. C.
INFLUENCE OF EXPERIMENTAL HYPOKINESIA ON GASTRIC SECRETORY FUNCTION
O. O. Markova, V. I. Vavrysihchuk, V. I. Rozvodovskyy, and V. A. Proshcheruk Apr. 1980 8 p refs Transl. into ENGLISH from Fiziol. Zh. (Kiev), v. 23, no. 5, 1977 p 653-656 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76034) Avail: NTIS HC A02/MF A01 CSCL 06S

The gastric secretory function of rats was studied in 4, 8, 16 and 30 day hypokinesia. Inhibition of both the gastric juice secretory and acid producing functions was found. The greatest inhibition was observed on day 8 of limited mobility. By days 16 and 30 of the experiment, a tendency of the gastric secretory activity to return to normal was observed, although it remained reduced. R.E.S.

N80-23975*# National Aeronautics and Space Administration, Washington, D. C.
POSSIBILITIES OF FORECASTING HYPERCHOLESTERINEMIA IN PILOTS
P. Vivilov Mar. 1980 9 p Transl. into ENGLISH from Kazanskiy Meditsinskiy Zh. (USSR), v. 60, no. 3, May-Jun. 1979 p 18-20 Transl. by Kanner (Leo) Associates, Redwood City, Calif.
(Contract NASw-3199)
(NASA-TM-76087) Avail: NTIS HC A02/MF A01 CSCL 06P

The dependence of the frequency of hypercholesterinemia on the age, average annual flying time, functional category, qualification class, and flying specialty of 300 pilots was investigated. The risk probability coefficient of hypercholesterinemia was computed. An evaluation table was developed which gives an 84% probability of forecasting risk of hypercholesterinemia. R.E.S.

N80-23976*# National Aeronautics and Space Administration, Washington, D. C.
PROCEDURE OF PRACTICAL EXERCISE WITH STUDENTS ON THE PATHOGENIC EFFECT OF ACCELERATIONS ON THE ORGANISM
I. M. Tyrtyshnikov and L. M. Tarasenko Apr. 1980 5 p refs Transl. into ENGLISH from Patol. Fiziol. Eksperim. Terapiya (USSR), no. 4, Jul Aug. 1978 p 81-82 Transl. by Scientific Translation Service, Santa Barbara, Calif. Original doc. prepared by Poltava Med. Stomatological Inst., USSR
(Contract NASw-3198)
(NASA-TM-76120) Avail: NTIS HC A02/MF A01 CSCL 06S

The effects of acceleration alone and coupled with administration of either aminazine (chlorpromazine- a sedative) or caffeine (a stimulant) on the development of kinetoses in mice were studied. The problem is presented as a method to teach students and to demonstrate the role of the nervous factor in the development of kinetosis. R.E.S.

N80-23977*# National Aeronautics and Space Administration, Washington, D. C.
ON THE PRESERVATION OF EQUILIBRIUM IN THE ORTHOGRADE AND INVERTED POSITIONS OF THE BODY
L. P. Semenov and N. A. Rebyakova Apr. 1980 7 p Transl. into ENGLISH from Teor. i Prakt. Fiz. Kul't. (USSR), no. 5, 1979 p 29-30 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-76141) Avail: NTIS HC A02/MF A01 CSCL 06P

The mechanism which regulates the vertical posture when maintaining equilibrium in an inverted position of the body is discussed. R.E.S.

N80-23978# Clemson Univ., S.C. College of Engineering.
AN EXPERIMENTAL EVALUATION OF SELECTED REWARMING THERAPIES FOR THE TREATMENT OF PROFOUND ACCIDENTAL HYPOTHERMIA, PART 2 Final Report, 5 Jun. 1978 - 30 Jun. 1979
R. Michael Harnett, Edward M. OBrien, Fred R. Sias, and James R. Pruitt 27 Aug. 1979 60 p refs
(Contract DOT-CG-72074-A)
(AD-A078292; USCG-D-65-79-Pt-2) Avail: NTIS HC A04/MF A01 CSCL 06/5

This report summarizes the results of rewarming experiments performed with mildly cooled volunteers. Rewarming therapies are studied which can be used for treatment of hypothermia at the rescue site. Other therapies are included in the study to serve as standards of comparison for the (portable) ones. The results are analyzed in the context of expected human responses to arrive at comparative evaluations of the therapies for use in the treatment of (profound) hypothermia. GRA

N80-23979# Battelle Pacific Northwest Labs., Richland, Wash.
PROCEEDINGS OF THE WORKSHOP ON ELECTRICAL AND BIOLOGICAL EFFECTS RELATED TO HVDC TRANSMISSION
T. D. Bracken, ed (Bonneville Power Administration, Vancouver, Wash.) Aug. 1979 209 p refs Conf. held at Richland, Wash., 19-20 Oct. 1978
(Contract EY-76-C-06-1830)
(PNL-3121) Avail: NTIS HC A10/MF A01

Six papers are presented on various aspects of electrical and biological effects related to high voltage direct current transmission. R.E.S.

N80-23980# California Univ., Los Angeles. Nuclear Medicine and Radiation Biology Lab.
POSITRON EMISSION TOMOGRAPHY OF THE HEART
Heinrich R. Schelbert, Michael E. Phelps, and D. E. Kuhl 1979 34 p refs
(Contracts EY-76-C-03-0012; DE-AM03-76SF-00012)
(UCLA-12-1232) Avail: NTIS HC A03/MF A01

Positron emission computed tomography (PCT) represents an important new tool for the noninvasive evaluation and, more importantly, quantification of myocardial performance. Most currently available techniques permit assessment of only one aspect of cardiac function, i.e., myocardial perfusion by gamma scintillation camera imaging with Thallium-201 or left ventricular function by echocardiography or radionuclide angiocardiography. With PCT it may become possible to study all three major segments of myocardial performance, i.e., regional blood flow, mechanical function, and most importantly, myocardial metabolism. Each of these segments can either be evaluated separately or in combination. The principles and technological advantages of the imaging device are described. Currently available radioactive tracers and how they can be employed for the assessment of flow, function and metabolism are reviewed. Possible applications of PCT for the study of cardiac physiology of its potential role in the diagnosis of cardiac disease are discussed. DOE

N80-23981# IIT Research Inst., Chicago, Ill. Physics Div.
STUDY OF THE POSSIBLE EFFECTS OF 110 kHz ELECTROMAGNETIC FIELDS ON HUMANS
Sep. 1979 71 p refs
(Contract EY-76-C-04-0789)
(SAND-77-7028) Avail: NTIS HC A04/MF A01

The effects of the magnetic field on humans, in particular those wearing pacemakers, was investigated using pacemakers inserted in a simulated (phantom) human being. The tests performed were on a worst case basis. That is, for one set of tests the most sensitive of the several cardiac pacemakers tested was used in the simulated human being (phantom) tests. Furthermore, the largest observed pacemaker lead pickup area was used with the most sensitive pacemaker, and in some of the tests the pacemaker lead was oriented for maximum pickup with the phantom being placed in the strongest magnetic field. A discussion of the types of the tests as well as the electrical pickup mechanism is given. The results are presented and discussed in relation to the development of an electronic, remotely detected credential for personnel identification within security areas. R.E.S.

N80-23982# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).
RHYTHMIC VORTEX CURRENTS AND THEIR SIGNIFICANCE IN HUMAN PHYSIOLOGY [RHYTHMISCHE WIRBELSTROEMUNGEN UND IHRE BEDEUTUNG FUER DEN PHYSIOLOGISCHEN HAUSHALT DES MENSCHEN]
Peter E. M. Schneider Mar. 1979 189 p refs In GERMAN (MPIS-1/1979) Avail: NTIS HC A09/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 31,20

The consequences of interactive fluid flows in the human body are discussed. The Marangoni instability is described, along with some cellular and ring vortex currents. A system theory is presented, and the functional and morphological processes in the human digestive tract examined. Author (ESA)

N80-23983# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
SUMMARIES OF SOME REPORTS OF 1978 CONCERNING RESULTS OF FIELD EXPERIMENTS FOR VISIBILITY
Hans-Eberhard Hoffmann, Ruediger Buell, and Werner Kuehnemann Sep. 1979 38 p refs
(DFVLR-Mitt-79-11) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 6,60

The Results of field tests for determining the visibility ranges, maximum detection range, maximum recognition range, and maximum identification range when observing air-to-land and air-to-sea are presented. The influence of the following parameters on the visibility ranges are emphasized: location, size, manner of illumination, movement and non-movement of ground targets; meteorological visibility; adaptation luminance; flight altitude and observation devices. Author (ESA)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N80-23984 Clemson Univ., S.C.
A DISCRIMINANT ANALYSIS OF PILOT PERFORMANCE PREDICTION AND SELECTION FOR AIR-TO-AIR COMBAT Ph.D. Thesis
Dwight Wilson Polk 1979 108 p
Avail: Univ. Microfilms Order No. 8010554

Data from Southeast Asian conflict were partitioned into five epochs. Four sets of discriminant functions based on training and experience factors were derived. Each set of functions was obtained from the data of a particular epoch and was used to predict the results of a subsequent epoch. Predicted and actual results provided the basis for determining the effectiveness of computed discriminant functions in predicting successes and failures in decisive engagements. For the majority of the cases studied discriminant functions predicted results correctly in approximately the same proportions as a random classification process. However, when air combat maneuvering training of tactical flying experience were used to predict results in an early period of the conflict, the discriminant function predictions exceeded random classifications in accuracy by better than ten percent. In the last period of the conflict, flight position which

is actually a pseudo training and experience factor because of the confounding of training and experience information within it was an effective indicator of engagement outcomes. These results are consistent with a tactical analysis of the conflict.
Dissert. Abstr.

N80-23985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
CLARIFICATION PROCESS: RESOLUTION OF DECISION-PROBLEM CONDITIONS
Duncan L. Dieterly May 1980 24 p refs
(NASA-TM-81193; AFHRL-H-80-101; A-8162) Avail: NTIS HC A02/MF A01 CSCL 05J

A model of a general process which occurs in both decisionmaking and problem-solving tasks is presented. It is called the clarification model and is highly dependent on information flow. The model addresses the possible constraints of individual indifferences and experience in achieving success in resolving decision-problem conditions. As indicated, the application of the clarification process model is only necessary for certain classes of the basic decision-problem condition. With less complex decision problem conditions, certain phases of the model may be omitted. The model may be applied across a wide range of decision problem conditions. The model consists of two major components: (1) the five-phase prescriptive sequence (based on previous approaches to both concepts) and (2) the information manipulation function (which draws upon current ideas in the areas of information processing, computer programming, memory, and thinking). The two components are linked together to provide a structure that assists in understanding the process of resolving problems and making decisions.
R.E.S.

N80-23986# Oregon Univ., Eugene. Dept. of Psychology.
PREPARATION COST AND DUAL-TASK PERFORMANCE: FURTHER EVIDENCE AGAINST A GENERAL TIME-SHARING FACTOR
Harold L. Hawkins, Elizabeth Ollich-Rodriquez, Thomas O. Halloran, R. Daniel Ketchum, David B. Bachmann, and Gerald M. Reicher Aug. 1979 38 p ref
(Contract N00014-77-C-0643; NR Proj. 150-407)
(AD-A080857; TR-5) Avail: NTIS HC A03/MF A01 CSCL 05/8

The time-sharing performance of 12 pilot trainees and 12 subjects with no pilot training was evaluated on 8 dual-task and 4 single-task conditions. Three task characteristics-input modality (auditory or visual), output modality (vocal or manual), and task difficulty (easy or difficult)--were systematically manipulated across conditions in an effort to vary the nature of the specific time-sharing demands imposed. To assess their generality, time-sharing factors were correlated across task conditions. A factor was considered general if it correlated across conditions imposing dissimilar time-sharing demands. The result suggest that (a) neither an ability to time-share efficiently nor an ability to effectively prepare for multiple tasks is a general factor in dual-task performance, and (b) effective preparation for multiple tasks is a skill that increases with piloting experience.
GRA

N80-23987# European Space Agency, Paris (France).
PSYCHOLOGICAL SELECTION OF SPACELAB PAYLOAD SPECIALISTS. THE EVALUATION OF GERMAN APPLICANTS
Klaus-Martin Goeters, E. Schwartz, C. Budczinski, M. Nordhausen, and B. Repp Nov. 1979 26 p refs Transl. into ENGLISH of "Psychologische Auswahl von Spacelab-Nutzlastexperten: Die Eignungsuntersuchung Deutscher Bewerber", Rept. DFVLR-FB-78-29 DFVLR, Godesberg, West Germany, Oct. 1978 Original report in GERMAN previously announced as N79-30936 Original German report available from ZLDI, Munich DM 13.20
(ESA-TT-586; DFVLR-FB-78-29) Avail: NTIS HC A03/MF A01

Criteria and methods used for the psychological selection of scientific astronauts (payload specialists) are described. The evaluation of 103 German Spacelab applicants is reported.
Author (ESA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N80-23988*# Essex Corp., Huntsville, Ala.
EVA MANIPULATION AND ASSEMBLY OF SPACE STRUCTURE COLUMNS
Tomas E. Loughead and Edwin C. Pruett May 1980 58 p
(Contract NAS8-32989)
(NASA-CR-3285; M-299) Avail: NTIS HC A04/MF A01 CSCL 05H

Assembly techniques and hardware configurations used in assembly of the basic tetrahedral cell by A7LB pressure-suited subjects in a neutral bouyancy simulator were studied. Eleven subjects participated in assembly procedures which investigated two types of structural members and two configurations of attachment hardware. The assembly was accomplished through extra-vehicular activity (EVA) only, EVA with simulated manned maneuvering unit (MMU), and EVA with simulated MMU and simulated remote manipulator system (RMS). Assembly times as low as 10.20 minutes per tetrahedron were achieved. Task element data, as well as assembly procedures, are included.
R.E.S.

N80-23497*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
MANNED MANEUVERING UNIT LATCHING MECHANISM
Charles S. Allton *In* NASA. Langley Res. Center Proc. of the 14th Aerospace Mech. Symp. May 1980 p 9-18 (For primary document see N80-23495 14-31)
Avail: NTIS HC A15/MF A01 CSCL 05H

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N80-23989 Auburn Univ., Ala.
A DYNAMICALLY RECONFIGURABLE DISTRIBUTED COMPUTING SYSTEM Ph.D. Thesis
Charles Ralph Vick 1979 245 p
Avail: Univ. Microfilms Order No. 8008385

A distributed architecture is described which integrates the fundamental concepts and qualities of pipelining and parallel processing into the basic structure. The architecture is a network of processors where each node in the network is called a

computing station (CS) and executes a well defined single entry - single exit procedure. It may be considered a type of data flow architecture in that packets of data called data item state vectors (DI SV's), trigger a given CS that not only operates on the data to produce a transformation but routes it to the next appropriate CS in the network. The routing function is not necessarily deterministic at design time, but may depend on the content of the given DI SV and the procedure within the CS that operates on it. Dissert. Abstr.

N80-23990# General Electric Co., Utica, N. Y.
NONLINEAR SYSTEM IDENTIFICATION STUDY. PART 1: IMPLEMENTATION FEASIBILITY STUDY Final Technical Report, Jan. - Sep. 1979
E. J. Ewen Griffiss AFB, N.Y. RADC Dec. 1979 189 p refs
(Contract F30602-79-C-0046; AF Proj. 2338)
(AD-A081464; RADC-TR-79-199-Pt-1) Avail: NTIS HC A09/MF A01 CSCL 09/2

The implementation feasibility of a nonlinear system identification technique is evaluated in this report. The identification technique uses a 'black box' approach requiring measurements only at system input and output terminals and is applicable to weakly nonlinear systems whose behavior is adequately characterized by a finite Volterra series. Three hardware implementations of the identification technique are postulated and their respective performances are evaluated. The impact of A/D converter quantization error, non-ideal amplifiers, multipliers and integrators on performance of the identification process is assessed. Performance requirements for each of the three implementations are derived via simulation and analysis. The feasibility of implementing the technique using commercially available state of the art components and measurement equipment in each implementation is assessed. RADC-TR-79-199, Part 2, A computational complexity study of the identification technique processing to determine the class of nonlinear systems to which the technique can be practically applied will be published at a later date. GRA

N80-23991*# Maryland Univ., College Park. Dept. of Computer Science.
ZMOB: A MOB OF 256 COOPERATIVE Z80A-BASED MICROCOMPUTERS
Chuck Rieger Nov. 1979 20 p refs
(Grant NsG-7253; Contract N00014-76-C-0477)
(NASA-CR-163129; AD-A081346; TR-825) Avail: NTIS HC A02/MF A01 CSCL 09/2

Current directions of computer science and computing in general are toward more parallel machine architectures and distributed models of computing based upon these new architectures. Recently, there has been considerable interest in highly parallel architectures capable of supporting complex distributed computation via a large number of autonomous processors. ZMOB is such a machine, currently under design and simulation. Architecturally, ZMOB is a collection of 256 identical but autonomous Z80A-based microcomputers (processors). Each processor comprises 32K bytes of 375 ns read/write central memory (expandable to 48K bytes), up to 4K bytes of resident operating system on 450ns EPROM, an 8-bit hardware multiplier, and interface logic for communications functions. GRA

N80-23992# South Carolina Univ., Columbia. Dept. of Electrical and Computer Engineering.
MULTIPLE MICROCOMPUTER CONTROL ALGORITHM Final Report, Sep. 1978 - Sep. 1979
Robert O. Pettus, Ronald D. Bonnell, Michael N. Huhns, Larry M. Stephens, and Gregory M. Wierzba Sep. 1979 203 p refs
(Contract N61338-78-C-0157)
(AD-A080735; NAVTRAEQUIPC-78-C-0157-1) Avail: NTIS HC A10/MF A01 CSCL 09/2

The design, analysis and performance evaluation of the architecture of a mutiprocessor is presented. The architecture is a hierarchically structured, functionally distributed, multiple microcomputer system. Its operating system is a multi-level structure implemented in an optimal combination of hardware, firmware, and software. This architecture is suited to any application, such as process control or real-time system simulation, in which the basic computational tasks do not change in time. Control functions are distributed among the microcomputer; however, the scheduling and execution of these tasks is governed at each microcomputer level by a local, real-time operating system. This local operating system is implemented primarily in firmware to minimize overhead. However, the control structure is designed to be independent of implementation so that a variety of microcomputers can be utilized together. Moreover, it is possible to add to each local processor an additional subprocessor which implements the operating system. GRA

N80-23993# Wayne State Univ., Detroit, Mich.
INTERCONNECTION NETWORK IN MULTIPLE-PROCESSOR SYSTEMS Final Technical Report, May 1976 - Jun. 1979
Tse-Yun Feng and Chuan-Lin Wu Griffiss AFB, N.Y. RADC Dec. 1979 244 p refs
(Contract F30602-76-C-0282; AF Proj. 5597)
(AD-A080959; RADC-TR-79-304) Avail: NTIS HC A11/MF A01 CSCL 09/2

The class of multistage interconnection networks with the configuration is introduced as a reverse-exchange interconnection network which is shown to be a powerful interconnection network for the parallel processing system. A recursive formula is derived to calculate the control pattern of the network for each of four realizable permutation classes. The recursive formulas can provide superior operating speed over the existing routing algorithms. It is proven that all permutations can be realized by the reverse-exchange network in two passes. Both the construction and routing algorithms are provided. Our results compares favorably with those of other networks. GRA

N80-23994# Army Engineer Topographic Labs., Wright-Patterson AFB, Ohio. Hydraulics Lab.
PLANNING OF AUTOMATED DATA ACQUISITION AND PROCESS CONTROL SYSTEMS (ADACS) Final Report
Roger H. Multer Jan. 1980 43 p
(AD-A081043; WES-MP-HL-80-1) Avail: NTIS HC A03/MF A01

This report deals with the planning of Automated Data Acquisition and Control Systems (ADACS) and is written to introduce the general engineering and management audience to the types of considerations which must be addressed for successful implementation of such systems. Brief discussions are presented on such topics as basic system requirements, minicomputer components, systems implementation, programming of minicomputers, data acquisition, process control, and data transmission. The ADACS developed for use at the Chesapeake Bay model, a large hydraulic model of the Chesapeake Bay, is discussed as an example of WES experience. GRA

N80-23995# Naval Academy, Annapolis, Md. Engineering and Weapons Div.
SYNTHESIS OF OPTIMAL FILTERS USING MICROCOMPUTERS Progress Report, Jan. - May 1979
Tian S. Lim Aug. 1979 21 p refs
(AD-A081045; USNA-EW-8-79) Avail: NTIS HC A02/MF A01

This project deals with optimal synthesis of an RC high-pass ladder network. It shows how to obtain a network with the maximum possible gain and minimum total series capacitance. The current transfer function, source and load conductances are specified. Lagrange multipliers method is used to obtain optimization. The entire process is completed using a microcomputer which can handle a large number of poles and can perform the optimization in a very short time. GRA

N80-23996# Pacific Missile Test Center, Point Mugu, Calif. Weapons Instrumentation Div.
OPTIMUM DIGITAL DATA STORAGE ON MAGNETIC TAPE
E. L. Law and W. R. Hedeman, Jr. Washington Naval Air Systems Command Dec. 1979 15 p
(AD-A081049; PMTC-TP-80-03) Avail: NTIS HC A02/MF A01 CSCL 09/2

In recent years considerable effort has been expended on high density digital recording. The goal has been to increase the data storage per unit length of tape, usually focused on a fixed track width. The present investigation advances the thesis

that optimum data storage per square of tape is achieved by increasing the number of tracks, rather than the storage per track. An experimental method for the determination of the best operating point is described, and data is presented for Non-Return-to-Zero-Level (NRZ-L), Manchester and Miller codes for an ideal tape recorder, and also for an actual tape recorder. GRA

N80-23997# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
SIMPLE MICROCOMPUTER INTERFACE TO INSTRUMENTS WITH PARALLEL DECIMAL (BCD) OUTPUTS
P. E. Ridgeway 1979 7 p ref
(Contract EY-76-C-04-0656)
(GEPP-397) Avail: NTIS HC A02/MF A01

A simple interface to couple a microcomputer to almost any parallel BCD output device using the 8255 Programmable Peripheral Interface I.C. is described. A typical connection is shown, and a flow chart and program illustrate the software required. DOE

N80-23998# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
COMPUTER SCIENCE AND TECHNOLOGY: SELECTION OF DATA ENTRY EQUIPMENT
Steve A. Recicar Nov. 1979 80 p
(PB80-144322; NBS-SP-500-55; LC-79-600173) Avail: NTIS HC A05/MF A01 CSCL 09B

Economic and general operational considerations, steps to be followed in acquisition and training, and other factors pertinent to data entry equipment selection are presented. Equipment profiles for the different data entry methods are also provided. GRA

N80-23999# National Bureau of Standards, Washington, D.C. Inst. for Computer Sciences and Technology.
RECOVERY FROM SOFT ERRORS IN TRIPLICATED COMPUTER SYSTEMS OPERATING IN LOCK-STEP
A. L. Koenig and A. W. Holt Nov. 1979 30 p Sponsored in part by DNA
(PB80-126931; NBSIR-79-1927) Avail: NTIS HC A03/MF A01 CSCL 09B

A triply modular redundant (TMR) computer system operating in clocked lock-step was investigated for an application requiring a mean time between failure of five years. No mechanical memories were used; this allowed comparison of the outputs of the three computers to be made each clock period. The most novel contribution was the method of recovery from soft errors, such as those produced by lightning strokes or alpha particles. Data are provided on the uptime history of an experimental system which uses three commercial microcomputers. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N80-24000 Stanford Univ., Calif.
GLOBAL PROGRAM ANALYSIS IN AN INTERACTIVE ENVIRONMENT Ph.D. Thesis
Larry Melvin Masinter 1980 113 p
Avail: Univ. Microfilms Order No. 8011678

The implementation and characteristics of a programming tool, called SCOPE. The program which aids programmers in dealing with large programs is described. SCOPE analyzes a user's programs, remembers what it sees, answers questions based on the facts it remembers, and incrementally updates its data base when a piece of the program changes. A variety of program analysis techniques are used within SCOPE to extract different kinds of information from programs. Examples include cross reference information, flow analysis, and data type inference. At the foundation, SCOPE embodies a representation system, in which properties of pieces of programs can be expressed. Representation systems are characterized by the entities they describe, the kind of facts they can contain and the manner in which the facts are derived. The basic entity which SCOPE deals with is the definition of a symbol, e.g., the definition of a procedure, record type, or macro. In particular, the facts SCOPE stores are not about individual statements of a program but rather about the definitions of symbols.
Dissert. Abstr.

N80-24001 Stanford Univ., Calif.
TECHNIQUES FOR PROGRAM VERIFICATION Ph.D. Thesis
Charles Gregory Nelson 1980 122 p
Avail: Univ. Microfilms Order No. 8011683

Two problems related to program verification are examined: choosing algorithms and data structures for the 'low-level' parts of a mechanical theorem prover that reason about important primitive operations such as equality, linear inequalities, and functions for operating on arrays and ordered pairs; and choosing a formal system that is suitable for reasoning about programs that manipulate pointers. The main result on the first problem is a method for combining 'satisfiability procedures' for two logical theories into a single satisfiability procedure for the combination of the theories. A satisfiability procedure is a program that determines the satisfiability of conjunctions of literals (signed atomic formulas). Implementation of the method in a theorem prover is described. The suggested solution to the second problem is that the specification language of the verification system be extended to allow nondeterministic partial recursive function definitions. A formal system is described for coding, specifying, and verifying programs that manipulate pointers. Dissert. Abstr.

N80-24002*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INTERACTIVE COMPUTER PROGRAM FOR SIZING SPACECRAFT MOMENTUM STORAGE DEVICES
F. J. Wilcox, Jr. Mar. 1980 40 p refs
(NASA-TM-81798) Avail: NTIS HC A03/MF A01 CSCL 09B

An interactive computer program was developed which computes the sizing requirements for nongimbled reaction wheels, control moment gyros (CMG), and dual momentum control devices (DMCD) used in Earth-orbiting spacecraft. The program accepts as inputs the spacecraft's environmental disturbance torques, rotational inertias, maneuver rates, and orbital data. From these inputs, wheel weights are calculated for a range of radii and rotational speeds. The shape of the momentum wheel may be chosen to be either a hoop, solid cylinder, or annular cylinder. The program provides graphic output illustrating the trade-off potential between the weight, radius, and wheel speed. A number of the intermediate calculations such as the X-, Y-, and Z-axis total momentum, the momentum absorption requirements for reaction wheels, CMG's, DMCD's, and basic orbit analysis information are also provided as program output. Author

N80-24003# Stanford Univ., Calif. Systems Optimization Lab.
SOLVING STAIRCASE LINEAR PROGRAMS BY THE SIMPLEX METHOD. 2. PRICING
Robert Fourer Nov. 1979 70 p refs
(Contract N00014-75-C-0267; DE-AS03-76SF-00326; Grants NSF MCS-76-20019; NSF ENG-77-0671)
(AD-A080838; SU-SOL-79-19) Avail: NTIS HC A01 CSCL 12/2

This and a companion paper share one goal: to solve staircase-structured linear programs faster through adaptation of the algorithms of the modern simplex method. Their means are quite different however, whereas the preceding paper concentrated on 'inversion' algorithms that factorize the basis and solve linear systems, the present paper looks are 'pricing' algorithms that select a variable to enter the basis at each iteration. Pricing involves two sets of algorithms: computation algorithm that determine reduced costs of the nonbasic variables, and selection algorithms that choose among variables whose reduced costs are favorable. This paper develops staircase adaptations of both sorts of algorithms, and reports extensive (although preliminary) computational experience. Staircase computation algorithms appear to offer modest but consistent savings; staircase selection algorithms, properly chosen, may offer substantial savings in number of iterations, time per iteration, or sometimes both. GRA

N80-24004# Stanford Univ., Calif. Systems Optimization Lab.
COMMENTS ON KHACHIAN'S ALGORITHM FOR LINEAR PROGRAMMING
George B. Dantzig Nov. 1979 7 p refs
(Contract N00014-75-C-0267; DE-AS03-76SF-00326; Grants NSF MCS-76-81259; NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A080837; SU-SOL-79-22) Avail: NTIS HC A02/MF A01 CSCL 12/2

Khachian's polynomial bound for finding a feasible solution to a relaxed linear program is an important theoretical result. Unfortunately, a polynomial bound does not imply a good algorithm because such a bound could be too large for problems of practical interest. For example, using the formulae in the original paper, practical problems with 3000 non-negative variables and 1000 equations (which are solved under one-half hour on IBM 370-168 using the simplex method) would involve over 10 to 15th power iterations and would take 50,000,000 years to solve using Khachian's method. GRA

N80-24005# George Washington Univ., Washington, D. C. Inst. for Management Science and Engineering.
FINDING THE GLOBAL MINIMUM OF A FUNCTION OF ONE VARIABLE USING THE METHOD OF CONSTANT SIGNED HIGHER ORDER DERIVATIVES
Garth P. McCormick 9 Nov. 1979 20 p refs
(Contracts DAAG29-79-C-0062; N00014-75-C-0729)
(AD-A081491; SERIAL-T-411) Avail: NTIS HC A02/MF A01 CSCL 12/2

A method for obtaining a global minimizer of the problem: minimize f(x) s.t. L equal to or less than X equal to or greater than U is presented when f(x) has kth order continuous derivatives. Subintervals are found on which certain derivatives have constant sign. An upward process then finds all the zeros of the first derivative in the interval. GRA

N80-24006# Naval Postgraduate School, Monterey, Calif.
AUTOMATIC FACTORIZATION OF GENERALIZED UPPER BOUNDS IN LARGE SCALE OPTIMIZATION PROBLEMS M.S. Thesis
David Samuel Thomen Sep. 1979 45 p refs
(AD-A081761) Avail: NTIS HC A03/MF A01 CSCL 12/1

To solve contemporary large scale linear, integer and mixed integer programming problems, it is often necessary to exploit intrinsic special structure in the model at hand. One commonly used technique is to identify and then to exploit in a basis factorization algorithm a generalized upper bound (GUB) structure (also called a static signed identity basis factorization). This report compares several existing methods for identifying GUB structure. Computer programs have been written to permit comparison of computational efficiency. The GUB programs have been incorporated in an existing optimization system of advanced design and have been tested on a variety of large scale real life optimization problems. The identification of GUB sets of maximum size is shown to be among the class of NP-complete problems; these problems are widely conjectured to be intractable in that no polynomial-time algorithm has been demonstrated for solving them. All the methods discussed in this report are polynomial-time heuristic algorithms that attempt to find, but do not guarantee, GUB sets of maximum size. Bounds for the maximum size of GUB sets are developed, in order to evaluate the effectiveness of the heuristic algorithms. GRA

N80-24007# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A RANDOM SAMPLER OF DYNAMIC PROGRAMMING APPLICATIONS IN SIGNAL PROCESSING AND CONTROL
Louis L. Scharf and Howard Elliott Dec. 1979 8 p refs
Presented at the 13th Ann. Asilomar Conf. on Circuits, Systems and Computers, 5-7 Nov. 1979 Sponsored in part by the Army Research Office and the Office of Naval Research
(AD-A081485;" CSU-TR-DEC79-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

Three classical problems, discrete Fourier analysis, linear prediction, and nonlinear phase and frequency demodulation are used to illustrate the use of dynamic programming in control and signal processing. The first two problems illustrate the use of dynamic programming in the (re-) derivation of the FFT and Levinson algorithms, two of the best known and most widely used fast algorithms. The last problem illustrates how dynamic programming can provide comfort in those applications where recursively computable, finite dimensional sufficient statistics are nowhere to be found. GRA

N80-24008# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
TRANSFORMING STATIC DATA STRUCTURES TO DYNAMIC STRUCTURES Interim Report
James B. Saxe and Jon Louis Bentley 3 Sep. 1979 70 p refs
(Contract N00014-76-C-0370)
(AD-A081438; CMU-CS-79-141) Avail: NTIS HC A04/MF A01 CSCL 12/1

In this paper we will investigate transformations that serve as tools in the design of new data structures. Specifically, we study general methods for converting static structures (in which all elements are known before any searches are performed) to dynamic structures (in which insertions of new elements can be mixed with searches). We will exhibit three classes of such transformations, each based on a different counting scheme for representing the integers, and then use a combinatorial model to show the optimality of many of the transformations. Issues such as online data structures and deletion of elements are also examined. To demonstrate the applicability of these tools, we will study six new data structures that have been developed by applying the transformations. GRA

N80-24009# Naval Postgraduate School, Monterey, Calif.
NON-NUMERICAL APPLICATIONS OF COMPUTER PROGRAMMING IN THE CONSTRUCTION OF PROBLEM ORIENTED LANGUAGES M.S. Thesis
Lawrence Bruce Elliott Dec. 1979 139 p refs
(AD-A081673) Avail: NTIS HC A07/MF A01 CSCL 09/2

A discussion of several non-numerical techniques that are useful in FORTRAN programming is presented. The use of these techniques is then illustrated with a problem oriented language called CAL-NPS. This last program is a derivation of a code named CAL written by Professor E. L. Wilson of the University of California, Berkeley, California. GRA

N80-24010# Naval Postgraduate School, Monterey, Calif.
COMPLEXITY AS A FACTOR OF QUALITY AND COST IN LARGE SCALE SOFTWARE DEVELOPMENT M.S. Thesis
Joe Newton Harris Dec. 1979 98 p refs
(AD-A081604) Avail: NTIS HC A05/MF A01 CSCL 09/2

The impact of complexity on software quality and costs is examined. Historic and current issues relating to complexity in the software development and software cost estimation processes are reviewed. Select complexity models and metrics are described and briefly analyzed. Finally, an argument is presented in support of McCabe's Directed Graph Model as a useful software management tool in controlling complexity, formulating a test strategy and allocating resources. GRA

N80-24011# General Research Corp., Santa Barbara, Calif.
USING EXECUTIVE ASSERTIONS FOR TESTING
D. M. Andrews and J. P. Benson Nov. 1979 8 p refs
(Contract F49620-79-C-0115; AF Proj. 2304)
(AD-A081488; GRC-TM-2282; AFOSR-80-0127TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

One of the ways of assuring greater reliability of software is to improve testing techniques. Three of the key problems associated with software testing are: choosing adequate test cases, assuring correctness of the results, and reducing the high cost of testing. Some degree of automation is required to help solve these problems. By combining the automated capability of adaptive testing with the use of executable assertions, it is possible to execute a program with a large number of test cases over a wide range of input values. The usual goal of adaptive testing is to maximize some performance value (objective function) for the software by automated perturbation of the input parameters. This technique only indirectly leads to locating errors, because of the time-consuming tasks of examining the usual output from the program. In software testing, the primary goal is to locate the maximum number of errors rather than maximize the

performance value. Since software errors can be detected by executable assertions, these assertions can be used to define an objective function for the Adaptive Tester so that a program can be tested automatically and a mapping made of its 'error space.' A search algorithm is used to generate new test cases based on past performance data about the number of assertion violations. Software testing can become much more efficient and effective through the use of adaptive testing with assertions, because such extensive testing increases the possibility of finding any existing errors and of improving software reliability. GRA

N80-24012# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
CONCURRENT MANIPULATION OF BINARY TREES, REVISION Interim Report
H. T. Kung and Philip L. Lehman Sep. 1979 46 p refs Revised
(Contract N00014-76-C-0370; Grant NSF MCS-78-23676)
(AD-A081443; CMU-CS-79-145-Rev) Avail: NTIS HC A03/MF A01 CSCL 09/2

The concurrent manipulation of a binary search tree is considered in this paper. The systems presented can support any number of concurrent processes which perform searching, insertion, deletion, and rotation(reorganization) on the tree, but allow any process to lock only a constant number of nodes at any time. Also, in the systems, searches are essentially never blocked. The concurrency control techniques introduced in the paper include the use of special nodes and pointers to redirect searches, and the use of copies of sections of the tree to introduce many changes simultaneously and therefore avoid unpredictable interleaving. Methods developed in this paper may provide new insights to other problems in the area of concurrent database manipulation. GRA

N80-24013# Science Applications, Inc., Englewood, Colo.
AN ANALYSIS OF SOFTWARE DESIGN METHODOLOGIES Technical Progress Report, 3 Oct. 1977 - 3 Dec. 1978
H. Rudy Ramsey, Michael E. Atwood, and Gary D. Campbell Aug. 1979 124 p refs
(Contract DAHC19-78-C-0005; DA Proj. 2Q7-62725-A-778) (AD-A081319; SAI-79-104-DEN; ARI-TR-401) Avail: NTIS HC A06/MF A01 CSCL 09/2

Four formal software design methodologies were described and briefly analyzed: (1) Structured Design, (2) Jackson's Methodology, (3) Integrated Software Development System (Higher Order Software), and (4) Warnier's: Logical Construction of Programs; strengths, weaknesses, and commonalities among the methods were identified and human factors problem areas were analyzed. Several major human factors deficiencies and problems were identified. Formal software design methods differ in terms of: Applicability to problems of different types, size or complexity; susceptibility to design errors; and constraints and limitations imposed on the software designer. Various methods limit the designer's ability to select an appropriate problem representation, prevent the designer from utilizing relevant knowledge and experience, or impose potentially significant information loads on the designer. Improvements in design methodologies require a better understanding of the problem-solving behavior of software designers; potential research topics in this area were identified. GRA

N80-24014# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
LOW-COST COMPUTER-AIDED INSTRUCTION/ COMPUTER-MANAGED INSTRUCTION CAI/CMI SYSTEM: FEASIBILITY STUDY Final Report
Larry M. Lintz and Thompson Tate Brooks AFB, Tex. AFSC Dec. 1979 152 p refs
(Contract F33615-78-C-0031; AF Proj. 1121)
(AD-A081072; AFHRL-TR-79-42) Avail: NTIS HC A08/MF A01

This study investigated the feasibility of a low-cost computer-aided instruction/computer-managed instruction (CAI/CMI) system. Air Force instructors and training supervisors were surveyed, to determine the potential payoffs of various CAI and CMI functions. Results indicated that a wide range of capabilities had potential for resident technical training. Surveys of selected computers, terminals, communications, and support software identified candidates for the low cost system. GRA

N80-24015# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
COMPUTER-ASSISTED INSTRUCTION IN THE CONTEXT OF THE ADVANCED INSTRUCTIONAL SYSTEM. PART 1: AUTHORING SUPPORT SOFTWARE Final Report
Ann D. Montgomery and Wilson A. Judd Brooks AFB, Tex. AFSC Dec. 1979 88 p refs
(Contract F33615-78-C-0022; AF Proj. 1121)
(AD-A081071; AFHRL-TR-79-12) Avail: NTIS HC A05/MF A01 CSCL 09/2

This report details the design, development and implementation of computer software to support the cost-effective production of Computer-Assisted Instruction (CAI) within the context of the Advanced Instructional System (AIS) located at Lowry AFB. This report supplements the computer managed Air Force technical training that is currently supported by AIS, giving the Air Force a full function Computer Based Instructional system. The interactive Authoring Editor, Presentation Program, Data Collection, and Data Print software components of the CAI system are detailed. The Editor simplifies the authoring task by (a) eliminating the need for the author to use a computer language, (b) structuring the task, (c) providing computer aided input, and (d) extensive formating and editing capabilities. The software also provides conditional and unconditional branching that can be specified from the Editor. GRA

N80-24016# Stanford Univ., Calif. Dept. of Operations Research.
EQUIVALENCE OF LCP AND PLS
B. C. Eaves and C. E. Lemke Dec. 1979 28 p refs
(Grants DAAG29-78-G-0026; NSF MCS-79-0563; NSF MCS-78-0296)
(AD-A080890; ARO-1915254.7-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

The linear complementarity problem and the piecewise linear system are the two principal models in complementary pivot and fixed point theory. It is shown that the path following methods for solving each are conceptually equivalent. GRA

N80-24017# Naval Postgraduate School, Monterey, Calif.
AUTOMATIC FACTORIZATION OF GENERALIZED UPPER BOUNDS IN LARGE SCALE OPTIMIZATION MODELS
Gerald G. Brown and David S. Thomen Jan. 1980 53 p refs
(AD-A081614; NPS55-80-003) Avail: NTIS HC A04/MF A01 CSCL 12/1

To solve contemporary large scale linear, integer and mixed integer programming problems, it is often necessary to exploit intrinsic special structure in the model at hand. One commonly used technique is to identify and then to exploit in a basis factorization algorithm a generalized upper bound (GUB) structure. This report compares several existing methods for identifying GUB structure. Computer programs have been written to permit comparison of computational efficiency. The GUB programs have been incorporated in an existing optimization system of advanced design and have been tested on a variety of large scale real life optimization problems. The identification of GUB sets of maximum size is shown to be among the class of NP-complete problems; these problems are widely conjectured to be intractable in that no polynomial-time algorithm has been demonstrated for solving them. All the methods discussed in this report are polynomial-time heuristic algorithms that attempt to find, but do not guarantee, GUB sets of maximum size. Bounds for the maximum size of GUB sets are developed, in order to evaluate the effectiveness of the heuristic algorithms. GRA

N80-24018# Stanford Univ., Calif. Systems Optimization Lab.
A PROJECTED LAGRANGIAN ALGORITHM FOR NONLINEAR MINIMAX OPTIMIZATION
Walter Murray and Michael L. Overton Nov. 1979 74 p refs
(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; DE-AT03-76ER-72018; Grant NSF MCS-76-20019)
(AD-A081069; SU-SOL-79-2115; ARO-16470.5-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

The minimax problem is an unconstrained optimization

problem whose objective functions is not differentiable everywhere, and hence cannot be solved efficiently by standard techniques for unconstrained optimization. It is well known that the problem can be transformed into a nonlinearly constrained optimization problem with one extra variable, where the objective and constraint functions are continuously differentiable. This equivalent problem has special properties which are ignored if solved by a general-purpose constrained optimization method. The algorithm we present exploits the special structure of the equivalent problem. A direction of search is obtained at each iteration of the algorithm by solving a equality-constrained quadratic programming problem, related to one a projected Lagrangian method might use to solve the equivalent constrained optimization problem. Special Lagrangian multiplier estimates are used to form an approximation to the Hessian of the Lagrangian function, which appears in the quadratic program. Analytical Hessians, finite-differencing or quasi-Newton updating may be used in the approximation of this matrix. The resulting direction of search is guaranteed to be a descent direction for the minimax objective function. Under mild conditions the algorithms are locally quadratically convergent if analytical Hessians are used. GRA

N80-24019# Stanford Univ., Calif. Systems Optimization Lab.

A GLOBALLY CONVERGENT CONDENSATION METHOD FOR GEOMETRIC PROGRAMMING

Eric Rosenberg Oct. 1979 28 p refs

(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00326; DE-AT03-76ER-72018; Grant NSF MCS-76-20019)

(AD-A081067; SU-SOL-79-11; ARO-16470.2-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

To solve a posynomial geometric program, rather than solve its dual directly, one solves the duals of a sequence of approximating geometric programs. Each approximating program, obtained by condensing certain terms of the given problem, has fewer degrees of difficulty than the given problem. Therefore, this method is to solve a sequence of problems, each posed in the same low dimensional space, rather than solve one problem in a higher dimensional space. The method requires a special sub-matrix of the matrix of exponents, and procedures to find such a sub-matrix are presented. A line search on an exact penalty function is employed. Under mild conditions, from any arbitrary starting solution estimate the method generates a sequence of estimates converging to a solution. The method also generates a sequence of lower bounds, thus providing an effective stopping criterion. A numerical example is presented. GRA

N80-24020# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

TASK REDUCTION SYSTEMS

H. J. Boom Mar. 1978 15 p refs Submitted for publication

(MC-IW-95/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The essential computational dependencies in a problem to be programmed can be expressed as a 'task replacement system' which indicates how tasks can be accomplished if other tasks are first accomplished. Associating good order with a suitable task replacement system can provide a constructive proof that an algorithm exists for solving a problem, without actually requiring the effort of writing a program. The method is demonstrated with simple examples. Author (ESA)

N80-24021# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

A FRAMEWORK FOR THE INTEGRATION OF GRAPHICS AND PATTERN RECOGNITION

Paul Klint and Marleen Sint May 1978 25 p refs Submitted for publication

(MC-IW-96/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A model is presented that describes a symmetric input/output function in a computer graphics system. This model is based on the construction of a symmetric input function by means of pattern recognition. Both theoretical and implementational aspects of this model are discussed. Author (ESA)

N80-24022# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

A SOUND AND COMPLETE HOARE-LIKE SYSTEM FOR A FRAGMENT OF PASCAL

K. R. Apt Jul. 1978 64 p refs Submitted for publication

(MC-IW-97/78) Avail: NTIS HC A04/MF A01; Stichting Math. Centrum, Amsterdam FL 7

A fragment of PASCAL is considered in which local declarations of simple variables, of array variables and of systems of mutually recursive parameterless procedures are allowed. A Hoare-like proof system for the fragment is presented which is proved to be both sound and complete in the sense of Cook. Author (ESA)

N80-24023# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.

A FINITE STATE LEXICAL ANALYZER FOR THE STANDARD HARDWARE REPRESENTATION OF ALGOL 68

H. B. M. Jonkers Sep. 1978 40 p refs Submitted for publication

(MC-IW-98/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

A finite state lexical analyzer for ALGOL 68 programs written in the standard hardware representation is described. The analyzer is written in a very simple language, allowing semi-mechanical translation to an arbitrary language. The whole language, including format-texts, is dealt with. Author (ESA)

N80-24024# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.

AN ALGORITHM WITH ALGOL 60 PROGRAM FOR THE COMPUTATION OF THE ZEROS OF ORDINARY BESSEL FUNCTIONS AND OF THEIR DERIVATIVES

N. M. Temme Jun. 1978 15 p refs Submitted for publication

(MC-TW-179/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

An algorithm is described for the computation of the zeros of the Bessel functions J sub a (x), Y sub a (x), J prime sub a (x), and Y prime sub a (x). The algorithm is given as an ALGOL 60 procedure. Author (ESA)

N80-24025# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.

LOGICAL INVESTIGATIONS ON PTQ ARISING FROM PROGRAMMING REQUIREMENTS

T. M. V. Janssen Nov. 1978 34 p refs Submitted for publication

(MC-ZW-117/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

Investigations on intensional logic which were stimulated by the development of a computer program for Montague's 'The Proper Treatment of Quantification in Ordinary English' are dealt with. Some problems which arose during the design of the algorithm of the program are considered and special attention is paid to the logical reduction rules which are used to simplify the expressions of intensional logic. An explicit list of these rules is presented with a strategy for their application. The correctness of these rules is proved together with some related results. Finally, several illustrative examples of generated sentences are considered and some inaccuracies and omissions in Montague's article are indicated. Author (ESA)

N80-24026# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.

A COMPARISON OF BOUNDS OF DELSARTE AND LOVASZ

A. Schrijver Oct. 1978 17 p refs Submitted for publication

(MC-ZW-118/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Two upper bound functions are compared: Delsarte's linear programming bound (an upper bound for the cardinality of cliques in association schemes) and Lovasz's theta-function (an upper bound for the Shannon capacity of a graph). It is shown that the two bounds can be treated in a unified fashion. Delsarte's linear programming bound can be generalized to a bound theta prime (G) for the independence number alpha (G) of arbitrary graphs G, such theta prime that (G) is less than or equal to

theta (G). On the other hand, if the edge set of G is the union of some classes of a symmetric association scheme, theta (G) may be calculated by means of linear programming. It is shown that for such graphs G the product theta (G) dot theta (bar G) is equal to the number of vertices of G. Author (ESA)

N80-24027# ERIA/ECA Automation, St. Cloud (France).
THE STUDY OF REAL-TIME SOFTWARE ON SPACE MISSIONS, VOLUME 1 Final Report
Apr. 1979 34 p refs In FRENCH; ENGLISH summary 3 Vol.
(Contract ESOC-3326/77-D-JS(SC))
(Rept-7T40423/MEG/JCR-Vol-1; ESA-CR(P)-1270-Vol-1) Avail: NTIS HC A03/MF A01

Four facets of software reliability were studied: techniques for quantitative assessment and prediction of software reliability, impact of programming languages on program reliability, parallelism and synchronization issues in real-time software, and fault-tolerance techniques. Several recommendations are made including the pratical use of several techniques for quantitatively assessing software reliability and the actual implementation of an integrated set of tools for software quality control. Author (ESA)

N80-24028# ERIA/ECA Automation, St. Cloud (France).
THE STUDY OF RELIABILITY OF REAL-TIME SOFTWARE FOR SPACE MISSIONS, VOLUME 2 Final Report [ETUDE SUR LA FIABILITE DES LOGICIELS TEMPS REEL DES MISSIONS SPATIALES]
Gerard Memmi and Jean-Claude Rault Jan. 1979 182 p refs In FRENCH 3 Vol.
(Contract ESOC-3326/77-D-JS(SC))
(ESA-CR(P)-1270-Vol-2; Rept-7T40423/MEG/JCR-Vol-2) Avail: NTIS HC A09/MF A01

Several techniques were examined for the quantitative measurement of software reliability. They include: the mathematical theory of reliability or assessment and prediction methods, and a method based on the complexity of software (structure complexity, text complexity, execution behaviour complexity). Author (ESA)

N80-24029# ERIA/ECA Automation, St. Cloud (France).
THE STUDY OF RELIABILITY OF REAL-TIME SOFTWARE FOR SPACE MISSIONS, VOLUME 3 Final Report [ETUDE SUR LA FIABILITE DES LOGICIELS TEMPS REEL DES MISSIONS SPATIALES]
Jan. 1979 126 p refs In FRENCH 3 Vol.
(Contract ESOC-3326/77-D-JS(SC))
(Rept-7T40423/MEG/JCR-Vol-3; ESA-CR(P)-1270-Vol-3) Avail: NTIS HC A07/MF A01

The impact of programming languages on program reliability is discussed. Parallelism and synchronization issues in real time software are analyzed. Fault tolerance techniques are presented. Mathematical theories of reliability are reviewed, and an example of a reliable system is provided. Author (ESA)

N80-24030# National Physical Lab., Teddington (England). Div. of Numeric Analysis and Computer Science.
A COMPARISON OF FOUR FORTRAN ROUTINES FOR DENSE LINEAR PROGRAMS
E. R. Brocklehurst and K. Dennis Oct. 1979 26 p refs
(NPL-NACS-19/79) Avail: NTIS HC A03/MF A01

Four algorithms for solving dense linear programs are compared in terms of speed and accuracy. From these comparisons inferences are drawn as to how the various tolerances can be determined automatically and how accuracy can be improved. Some of the conclusions reached apply also to algorithms for sparse linear programs. Author (ESA)

N80-24031# National Physical Lab., Teddington (England). Div. of Numerical Analysis and Computer Science.
COMPLEX ARITHMETIC IN FORTRAN
S. J. Hammarling, P. D. Kenward, and Hilary J. Symm Dec. 1979 12 p refs
(NPL-NACS-23/79) Avail: NTIS HC A02/MF A01

The use of FORTRAN to implement complex algorithms in portable software is discussed. The method is compared to implenting the complex algorithm in real arithmetic and allocating two real type values to represent each complex value. The advantages and disadvantages of the two approaches are described and suggestions are provided on means to interface them. Author (ESA)

N80-24032# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Computer Science.
SOME STATISTICS ON ALGOL 68 PROGRAMS
D. Grune May 1979 12 p refs Submitted for publication
(MC-IW-109/79) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2,88

An attempt is made to assess some static and dynamic properties of ALGOL 68 programs, which are useful for optimization decisions. The results indicate that slicing and assignation are the most important candidates for optimization. Author (ESA)

62 COMPUTER SYSTEMS

Includes computer networks.

No abstracts in this category.

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N80-24033 Pennsylvania State Univ., University Park.
CONTROL OF ENTRY TO A QUEUEING SYSTEM Ph.D. Thesis
Robert Charles Rue 1979 237 p
Avail: Univ. Microfilms Order No. 8010094

A semi-Markov approach is used to formulate an expanded M/M/1 model with several classes of customers, each with its own reward and holding cost rate. Socially optimal control of this model is shown to be provided by establishing a balking point for each class that is no greater than the balking point a member of the class would determine if he acted to maximize his own expected net benefit. A semi-Markov approach is also used to extend the several class model to include service times. A heuristic solution technique based on policy iteration and a solution technique using mixed integer programming are presented. The several class models are applied to the problem of determining an optimal policy for controlling the entry of commerical aircraft to the landing queue at an international airport. A socially optimal control policy is found and analyzed. Finally, the semi-Markov approach is used to formulate three other models: (1) a nonpreemptive priority model; (2) a class dependent service rate model; (3) a nonpreemptive priority model with class dependent service rates. Dissert. Abstr.

N80-24034# Michigan Univ., Ann Arbor. Dept. of Aerospace Engineering.
SYSTEM OPTIMIZATION BY PERIODIC CONTROL Interim Report
Elmer G. Gilbert Sep. 1979 11 p refs
(Grant AF-AFOSR-3158-77; AF Proj. 2304)
(AD-A080295; AFOSR-80-0045TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

Four new papers were published or in preparation during the past year. The results are in four main areas: (1) frequency domain tests for optimality in problems of periodic control, (2) infinite-horizon problems as natural extension of traditional problems in periodic control, (3) applications of periodic control to aircraft cruise, and (4) minimal realization of nonlinear (functional 2 power) input/output maps. GRA

N80-24035# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.

QUEUEING NETWORKS
Ralph L. Disney Dec. 1979 35 p refs
(Contract N00014-77-C-0743; Grant NSF ENG-77-22757; NR Proj. 042-296)
(AD-A081257; VTR-79-23) Avail: NTIS MF A03/MF A01 CSCL 12/1

The study of queueing networks is a rather recent addition to queueing theory. In this paper we will review about the last 20 years of developments in the area. Primary emphasis is placed on Jackson networks and the major contribution of Kelly. We discuss queue length processes, waiting time processes, busy period processes and departure processes. We will also note a few new studies that have appeared in the area of network flows. Topics that are not discussed in detail in the paper are briefly noted in the final section. The bibliography can serve as an introduction for further reading in the area. GRA

N80-24036# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
SOME RESULTS ON SOJOURN TIMES IN ACYCLIC JACKSON NETWORKS, REVISION
Burton Simon and Robert D. Foley Dec. 1978 16 p refs Revised
(Contract N00014-77-C-0743; Grant NSF ENG-77-22757)
(AD-A080737; VTR-79-01-Rev) Avail: NTIS HC A02/MF A01 CSCL 12/1

Studies are made on sojourn times in acyclic, Jackson networks as part of a survey of equilibrium results. Argument is made that a particular customer has a sojorun time at node i that is independent of his remaining sojourn time in the network given that the customer transfer from node i to node j. This assumption is then used to derive a set of equations involving the Laplace-Stieltjes transform of the sojourn times at each node from which several properties of sojourn times are determined. GRA

N80-24037# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ON OPTIMISTIC METHODS FOR CONCURRENCY CONTROL Interim Report
H. T. Kung and John T. Robinson Oct. 1979 21 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-78-23676)
(AD-A081452; CMU-CS-79-149) Avail: NTIS HC A02/MF A01 CSCL 09/2

Most current approaches to concurrency control in database systems rely on locking of a data objects as a control mechanism. In this paper, two families of non-locking concurrency controls are presented. The methods used are ('optimistic' in the sense that rely mainly on transaction backup as a control mechanism, 'hoping' that conflicts between transactions will not occur. Applications where these methods should be more efficient than locking are discussed. GRA

N80-24038# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Industrial Engineering and Operations Research.
THE M/G/1 QUEUE WITH INSTANTANEOUS BERNOULLI FEEDBACK Technical Progress Report, period ending 1979
Ralph L. Disney, Donald C. McNickle (Univ. of Canterbury, New Zealand), and Burton Simon Dec. 1979 22 p refs
(Contract N00014-75-C-0492)
(AD-A081256; VTR-79-22) Avail: NTIS HC A02/MF A01 CSCL 12/1

This report concerns with several random processes that occur in M/G/1 queues with instantaneous feedback in which the feedback decision process is a Bernoulli process. Queue length processes embedded at various times are studied. It is shown that these do not all have the same asymptotic distribution, and that in general none of the output, input, or feedback processes is renewal. These results have implications in the application of certain decomposition results to queueing networks. GRA

N80-24039# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Systems.
AN ALGORITHM FOR AVERAGE COSTS DENUMERABLE STATE SEMI-MARKOV DECISION PROBLEMS WITH APPLICATIONS TO CONTROLLED PRODUCTION AND QUEUEING SYSTEMS
H. C. Tijms Oct. 1978 36 p refs Submitted for publication
(MC-BW-94/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

A computational approach is presented for typical applications of average costs denumerable state semi-Markov decision problems as arising in controlled production and queueing systems. This approach combines policy-iteration and embedding techniques to develop, by exploiting the structure of the application considered, a tailor-made algorithm for computing an optimal policy within a given class of intuitively reasonable policies having a simple form. An M/G/1 queueing system with controllable service time distribution, a discrete production problem in which the inventory is controlled by turning on or off the production, and an M/M/c queueing system in which the number of servers operating can be controlled are considered as applications. Author (ESA)

N80-24040# Fondazione Ugo Bordoni, Rome (Italy).
A SIMULA PROGRAM FOR INVESTIGATING A CLASS OF QUEUEING NETWORKS
Mauro Brizzi and Davide Grillo Oct. 1978 22 p refs
(FUB-40-1978) Avail: NTIS HC A02/MF A01

A queueing network model is described that may be applied to the analysis of real time distributed control systems. The model combines the main features of the BCMP class with others more common in real time systems. A simulation program for investigating the network model is discussed with reference to making use of the SIMULA programming language. The mechanism through which SIMULA manages discrete-state-continuous-time systems is described, and some broad indications are given concerning mapping procedures. Author (ESA)

N80-24041# European Space Agency, Paris (France).
DIGITAL COMPENSATORS FOR SAMPLED SYSTEMS AND MINIMUM TIME CONTROL
Alain Bernard Apr. 1980 44 p refs Transl. into ENGLISH of "Correcteurs Numeriques pour Systemes Echantillonnes et Commande en Temps Minimum", Rept. ONERA-NT-1979-3 Onera, Paris, 1979 Original report in FRENCH previously announced as N80-13038
(ESA-TT-607; ONERA-NT-1979-3) Avail: NTIS HC A03/MF A01

A method for determining and initializing numerical correctors is proposed. The optimal command is obtained in the case where the sampled transfer function of the open loop system presents only poles at the origin. The use of this method makes it possible to improve the response of any system presenting a number of poles at the origin. Author (ESA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N80-24042 Wayne State Univ., Detroit, Mich.
THE STRUCTURE OF MINIMAL GRAPHS WITH GIVEN ABELIAN AUTOMORPHISM GROUP Ph.D. Thesis
William Charles Arlinghaus 1979 216 p
Avail: Univ. Microfilms Order No. 8010117

The cycle structure of permutation groups is investigated, and necessary conditions are established for a permutation to represent an automorphism in a graph with abelian group. Candidates are constructed for minimal graphs with given cyclic group, and the above conditions are utilized to show that these candidates are indeed minimal. These methods are then used to find minimal graphs for abelian p-groups, first with two generators, and then (using induction) with an arbitrary number of generators. In general, these are suggested by the minimal graphs of the cyclic groups associated with the generators. The one class of exceptions is thoroughly developed. Finally, the results are extended to all abelian groups. Thus a complete classification is provided for minimal graphs with given finite abelian automorphism group. Dissert. Abstr.

N80-24043# Orange Free State Univ., Bloemfontein (South Africa).
PREDICTION, ESTIMATION AND MODEL SELECTION FOR MULTIVARIATE NORMAL POPULATIONS
D. J. deWaal, P. C. N. Groenewald, C. J. Lombard, D. G. Nel, and A. J. VanderMerwe May 1979 18 p refs
(TR-44) Avail: NTIS HC A02/MF A01

The prediction of future observations from multivariate normal populations is considered using Bayesian techniques and a predictive sample reuse method. Simulations comparing different estimators are made. Selecting the model that yields the best prediction is also considered. M.G.

N80-24044*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BOUNDARY CONDITIONS FOR THE NUMERICAL SOLUTION OF ELLIPTIC EQUATIONS IN EXTERIOR REGIONS
Alvin Bayliss, Max Gunzburger (Tennessee Univ.), and Eli Turkel (New York Univ.) [1980] 47 p refs
(Contracts NAS1-14101; Contracts DAAG29-78-C-0024; EY-76-C-02-3077)
(NASA-CR-153185; Rept-80-1) Avail: NTIS HC A03/MF A01 CSCL 12A

Elliptic equations in exterior regions frequently require a boundary condition at infinity to ensure the well-posedness of the problem. Examples of practical applications include the Helmholtz equation and Laplace's equation. Computational procedures based on a direct discretization of the elliptic problem require the replacement of the condition on a finite artificial surface. Direct imposition of the condition at infinity along the finite boundary results in large errors. A sequence of boundary conditions is developed which provides increasingly accurate approximations to the problem in the infinite domain. Estimates of the error due to the finite boundary are obtained for several cases. Computations are presented which demonstrate the increased accuracy that can be obtained by the use of the higher order boundary conditions. The examples are based on a finite element formulation but finite difference methods can also be used. Author

N80-24045# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
FINITE CRITERIA FOR CONDITIONAL DEFINITENESS OF QUADRATIC FORMS
D. H. Martin Aug. 1979 20 p refs Sponsored in part by Control Data Corp.
(CSIR-TWISK-115) Avail: NTIS HC A02/MF A01

Finite criteria, involving the solution of sets of linear equations constructed from the matrices Q,A (Q symmetric and n x n, A is m x n), for testing two types of conditional definiteness are presented. The real symmetric n x n matrix Q is A-conditionally positive semidefinite, where A is a given m x n real matrix, if x prime Q x > or = 0 whenever Ax > or = 0, and is A-conditionally positive definite if strict inequality holds except when x = 0. When A is the identity matrix these notions reduce to the well studied notions of copositivity and strict copositivity respectively. The criteria developed generalize known facts about copositive matrices, and, when Q is invertible and all rowsubmatrices of A have maximal rank, can be very elegantly stated in terms of Schur complements of the matrix AQ (-1) A prime. M.G.

N80-24046# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
UNIFORM LINEAR APPROXIMATION IN NORMED LINEAR SPACES
M. Brannigan Aug. 1979 17 p refs
(CSIR-TWISK-114) Avail: NTIS HC A02/MF A01

It was shown that the theory of H-sets is important in the characterization of best uniform approximation of continuous real- or complex-valued functions. The theory of H-sets is extended to the more general setting of functions with compact domain and with range contained in a Banach space. Using the definitions of H-sets, a maximal linear functional is constructed and inclusion theorems analogous to the classical case are obtained. It is then a simple matter to deduce a characterization of best approximation and show when uniqueness and strong uniqueness are achieved. F.O.S.

N80-24047# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
COPOSITIVE MATRICES AND DEFINITENESS OF QUADRATIC FORMS SUBJECT TO HOMOGENEOUS LINEAR INEQUALITY CONSTRAINTS
D. H. Martin and D. H. Jacobson May 1979 43 p refs
(CSIR-TWISK-89) Avail: NTIS HC A03/MF A01

A symmetric matrix C is called copositive if the quadratic form x prime C x is nonnegative for all nonnegative values of the variables (x sub 1, x sub 2,..., x sub n)= x prime e. A known sufficient condition for a quadratic from x prime Qx to be positive unless x=0, subject to the linear inequality constraints Ax equal to or greater than 0, is that there should exist a copositive matrix C such that Q - A prime CA is positive definite. The main result establishes the necessity of this condition. For x prime Qx to be merely nonnegative subject to Ax equal to or greater than 0, the situation is less straight-forward. The necessity of the existence of a copositive matrix C such that Q - A prime CA is positive semi-definite is proved only under various additional hypotheses regarding the size or rank of A, and counter examples are given to show that, in general, no such matrix may exist, even when Slater's constraint qualification holds. Our approach to these existence questions also furnishes certain tests for positivity or mere nonnegativity in which specific symmetric matrices, constructed by rational operations from A and Q and depending upon a single real parameter nu, must be tested for positive definiteness or strict copositivity for large values of nu. This technique is illustrated by several examples. F.O.S.

N80-24048# North Carolina Univ. at Chapel Hill. Inst. of Statistics.
EXPECTED NUMBER OF VERTICES OF A RANDOM CONVEX POLYTOPE. I: INTEGRAL FORMULA AND ASYMPTOTIC BOUNDS
D. G. Kelly and J. M. Tolle Jan. 1980 15 p refs
(Contract N00014-76-C-0550; Grant DAAG29-79-G-0014)
(AD-A080191; MIMEO-SER-1261) Avail: NTIS HC A02/MF A01 CSCL 12/1

Given m points on the unit sphere in n-sphere, the hyperplanes tangent to the sphere at the given points bound a convex polytope with m facets. If the points are chosen independently at random from the uniform distribution on the sphere, the number V sub mn of the vertices of the polytope is a random variable. An integral expression for EV sub mn and asymptotic bounds are obtained. GRA

N80-24049# Systems Technology, Inc., Hawthorne, Calif.
WIENER-HOPF APPROACHES TO REGULATOR, FILTER/OBSERVER, AND OPTICAL COUPLER PROBLEMS Final Report
Richard F. Whitbeck Jan. 1980 77 p refs
(Contract N00014-78-C-0391)
(AD-A081489; STI-TR-1125-1; ONR-CR215-260-1) Avail: NTIS HC A05/MF A01 CSCL 12/1

Most approaches to optimal linear stochastic control problems depend on time domain techniques for both their theoretical foundations and for computational algorithms. In contrast, this paper discusses innovations based on classical transform domain Wiener-Hopf theory. These innovations avoid several difficulties occurring in time domain solutions (e.g., those which arise in connection with singular regulator and filter problems). Emphasis will be placed upon solution techniques and properties in distinction to derivations. The following points will be demonstrated: linear regulator, filter/observer problems can be solved using linear algebraic equations (in distinction to solving nonlinear Riccati equations); the R weighting matrix need not be positive definite nor is it necessary that 1/R exists; singular regulator and filter/observer problems (e.g., the cheap control problem) can be handled neatly; the weighting matrices, R and Q, can be explicit functions of frequency; and there are some advantages in using non-diagonal Q and R matrices. GRA

N80-24050# Stanford Univ., Calif. Systems Optimization Lab.
SOLVING STAIRCASE LINEAR PROGRAMS BY THE SIMPLEX METHOD. 1: INVERSION
Robert Fourer Nov. 1979 84 p refs

(Contracts N00014-75-C-0267; DE-AS03-76SF-00326; DE-AT03-76ER-72018; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A081713; SU-SOL-79-18) Avail: NTIS HC A05/MF A01 CSCL 12/1

Problems of economic planning, production scheduling, inventory, transportation, control and multi-stage structural design have been modeled as linear programs that have a 'staircase' structure: their activities fall into a sequence of disjoint stages or periods, while their constraints relate only successive periods. At one time it was hoped that staircase linear programs would be particularly easy to solve, owing to their special structure, but experience with the most common solution technique, the general simplex method, has shown otherwise. Over the years many alternatives to the simplex method have also been proposed, but as yet none of these has been proved superior in solving a wide variety of staircase problems. This and a companion paper consider how the modern simplex method, as implemented for large computers, may be adapted to solve staircase linear programs more efficiently. Each paper looks at a set of algorithms within the simplex method: this one deals with 'inversion' of the basis - more accurately, solution of linear systems by Gaussian elimination and its successor c. siders the task of pricing. GRA

N80-24051# Naval Postgraduate School, Monterey, Calif.
ON THE COMPUTATIONAL COMPLEXITY OF BRANCH AND BOUND SEARCH STRATEGIES M.S. Thesis
Douglas R. Smith Nov. 1979 111 p refs
(Grant NSF MCS-74-14445)
(AD-A081608; NPS52-79-004) Avail: NTIS HC A06/MF A01 CSCL 12/1

Many important problems in operations research, artificial intelligence, and other areas of computer science seem to require search in order to find an optimal solution. A branch and bound procedure, which imposes a tree structure on the search, is often the most efficient known means for solving these problems. While for some branch and bound algorithms a worst case complexity bound is known, the average case complexity is usually unknown despite the fact that it gives more information about the performance of the algorithm. In this dissertation the branch and bound method is discussed and a probabilistic model of its domain is given, namely a class of trees with an associated probability measure. The best-bound-first search strategy and depth-first search strategy are discussed and results on the expected time and space complexity of these strategies are presented and discussed. The best-bound-first search strategy is shown to be optimal in both time and space. These results are illustrated by data from randomly generated traveling salesman problems. GRA

N80-24052# Dayton Univ. Research Inst., Ohio.
EIGENVALUE AND NEAR EIGENVALUE PROBLEMS SOLVED BY BRANDT'S MULTIGRID METHOD Interim Report, May - Jun. 1979
K. G. Guderley and Donald S. Clemm (AFFDL, Wright-Patterson AFB, Ohio) Sep. 1979 29 p ref
(Grant AF-AFOSR-3524-78; AF Proj. 2304)
(AD-A081318; AFFDL-TR-79-3147) Avail: NTIS HC A03/MF A01 CSCL 12/1

To illustrate Brandt's multigrid method this report considers the Helmholtz equation in cases where the frequency is close to an eigenfrequency. In a second part the eigenvalue problem is discussed. The basic idea for the treatment of the inhomogeneous problem is contained in Brandt's publications. Difficulties are encountered because the coarse grid eigenvalues differ from those of the finer grid. As a consequence, approximations to a solution in the coarse grid may differ widely from the corresponding approximation in a finer grid, if the frequency defined by the inhomogeneous problem is close to one of the eigenfrequencies. This may be detrimental to the aim of the coarse grid step: namely to remove from an approximation in a fine grid long waves which cause divergence of fine grid iterations. This is remedied by eliminating long wave contributions to the residual directly in the next finer grid. The success of this procedure still depends upon the choice of the subspace from which the long wave corrections in the finer grid are taken. Even this modified method fails if the frequency pertaining to the inhomogeneous term is too close to an eigenvalue, unless the subspace contains the pertinent eigenfunction. GRA

N80-24053# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
IMPLEMENTATION, INTERPRETATION AND ANALYSIS OF A SUBOPTIMAL BOUNDARY FINDING ALGORITHM
H. Cooper Elliott, D. B. Cooper, F. Cohen, and P. Symosek Jan. 1980 52 p refs
(Contract N00014-75-C-0518; Grants DAAG29-78-G-0124; NSF ENG-77-26788)
(AD-A081484; CSU-TR-JABO-DELENG-1) Avail: NTIS HC A04/MF A01 CSCL 12/1

This report presents a suboptimal boundary estimation algorithm for noisy images which is based upon an optimal maximum likelihood problem formulation. Both the maximum likelihood formulation and the resulting algorithm are described in detail, and computational results are given. In addition, the potential power of the likelihood formulation is demonstrated through the presentation of three simple but insightful analyses of algorithm performance. GRA

N80-24054# Colorado Univ. at Boulder. Dept. of Computer Science.
DETERMINING FEASIBILITY OF A SET OF NONLINEAR INEQUALITY CONSTRAINTS Interim Technical Report
Robert B. Schnabel Aug. 1979 54 p refs Presented at the 10th Intern. Symp. on Math. Programming, Montreal, Aug. 1979 and at the Fall ORSA-TIMS Meeting, Milwaukee, Oct. 1979
(Contract DAAG29-79-C-0023; Grants DAAG29-78-G-0046; NSF MCS-77-02194)
(AD-A081802; CU-CS-172-80; ARO-15074.11-M; ARO-15809.1-M) Avail: NTIS HC A04/MF A01 CSCL 12/1

Contents: Introduction, the new class of algorithms: a weighting function-penalty approach; termination properties of the new class of algorithms; choice of the weighting function; Computational results; summary and directions for further work. GRA

N80-24055# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
GEOMETRIC TRANSFORMS FOR FAST GEOMETRIC ALGORITHMS Ph.D. Thesis. Interim Report
Kevin Q. Brown Dec. 1979 161 p refs
(Contract N00014-76-C-0370)
(AD-A081448; CMU-CS-80-101) Avail: NTIS HC A08/MF A01 CSCL 12/1

Many computational problems are inherently geometrical in nature. For example, cluster analysis involves construction of convex hulls of sets of points, LSI artwork analysis requires a test for intersection of sets of line segments, computer graphics involves hidden line elimination, and even linear programming can be expressed in terms of intersection of half-spaces. As larger geometric problems are solved on the computer, the need grows for faster algorithms to solve them. The topic of this thesis is the use of geometric transforms as algorithmic tools for constructing fast geometric algorithms. We describe several geometric problems whose solutions illustrate the use of geometric transforms. These include fast algorithms for intersecting half-spaces, constructing Voronoi diagrams, and computing the Euclidean diameter of a set of points. For each of the major transforms we include a set of heuristics to enable the reader to use geometric transforms to solve his own problems. GRA

N80-24056# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. for Computer Science.
TWO PAPERS ON GRAPH EMBEDDING PROBLEMS Interim Report
James B. Saxe Jan. 1980 40 p refs
(Contract N00014-76-C-0370)
(AD-A081449; CMU-CS-80-102) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report contains two independent papers on problems concerned with graph embedding, i.e., assignment of the vertices of a graph to points in a metric space subject to specified constraints. The first paper in this report, 'Embeddability of weighted graphs in k-space is strongly NP-hard,' examines the problem of assigning the vertices of a weighted graph to points

in a k-dimensional Euclidean space subject to the constraint that any two vertices connected by an edge must be assigned to points whose distance is the weight of that edge. We prove (by reduction from 3-satisfiability) that it is NP-hard to determine whether such an assignment exists, even when k=1 and the edge weights are restricted to take on the values 1 and 2. The same reduction used in this proof forms the basis of proofs of the NP-completeness of several variants of the original problem. The second paper, 'Dynamic-programming algorithms for recognizing small-bandwidth graphs in polynomial time,' deals with the problem of bandwidth minimization, in which we are given a graph, G, and a positive integer, k, and whether it is possible to assign the vertices of G to distinct integers subject to the constraint that no edge of G may have its endpoints mapped to integers which differ by more than k. Although the general problem has been proven (by C. H. Papadimitriou) to be NP-complete, we show that it can be solved in polynomial time for any fixed value of k. As in the first paper, the methods used to achieve the principal result are extended to a number of related problems. GRA

N80-24057# Maryland Univ., College Park. Computer Vision Lab.
ALGORITHMS FOR TESTING CONVEXITY OF DIGITAL POLYGONS Interim Report
Reinhard Klette and E. V. Krishnamurthy Dec. 1979 22 p refs
(Grant AF-AFOSR-3271-77; AF Proj. 2304)
(AD-A081476; TR-841; AFOSR-80-0138TR) Avail: NTIS HC A02/MF A01 CSCL 12A

A simple approach based on Shoenberg's theorem is described to test whether a set of border points of a simply 4 connected digital picture is convex. The sequential implementation of this method is linear in the number of points; the parallel algorithm needs constant time only, using bitwise parallel Boolean operations and shifts on binary matrices. Suitable modifications of this approach can be used for decomposing two dimensional objects into convex sets and for filling concavities. GRA

N80-24058# Texas A&M Univ., College Station. Inst. of Statistics.
MODERN METHODS OF MULTIPLE SPECTRAL DENSITY ESTIMATION
H. Joseph Newton Mar. 1979 17 p refs
(Contract N00014-78-C-0599)
(AD-A081172; TR-N-8) Avail: NTIS HC A02/MF A01 CSCL 12/1

Methodology for estimating the spectral density of a multiple time series is presented. The windowed and autoregressive methods are described and a new estimator called the periodic autoregressive estimator is proposed. A worked example is given and a Fortran program written by the author is described. GRA

N80-24059# Texas A&M Univ., College Station. Inst. of Statistics.
EFFICIENT ESTIMATION OF MULTIVARIATE MOVING AVERAGE AUTOCOVARIANCES
H. Joseph Newton May 1979 5 p refs
(Contract N00014-78-C-0599)
(AD-A081173; TR-N-9) Avail: NTIS HC A02/MF A01 CSCL 12/1

A method is proposed for estimating the autocovariances of a d-dimensional moving average process of order q. The estimators have the same asymptotic covariance matrix as those obtained by maximizing a Gaussian likelihood, and are obtained by performing a generalized least squares regression of the periodogram on the autocovariance, thus extending Parson's estimators for d=1. J.M.S.

N80-24060# Texas A&M Univ., College Station. Inst. of Statistics.
TIME SERIES ANALYSIS METHODS AND APPLICATIONS INCREASED INTERDISCIPLINARY INTERACTION COULD STIMULATE RESEARCH BREAKTHROUGHS
Emmanuel Parzen Nov. 1979 11 p refs
(Contract N00014-78-C-0599)
(AD-A081174; TR-N-10) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper consists of three parts: (1) Classification of Researchers Applying and Developing Methods of Time Series Analysis; (2) Theory of Time Series Analysis; and (3) Current Fields of Application of Time Series Analysis. GRA

N80-24061# Stanford Univ., Calif. Systems Optimization Lab.
A NESTED PARTITIONING PROCEDURE FOR NUMERICAL MULTIPLE INTEGRATION
Jerome H. Friedman and Margaret H. Wright Nov. 1979 36 p refs
(Contracts DAAG29-C-0110; EY-76-C-03-0515; DE-AS03-76SF-00326; Grant NSF MSC-76-20019)
(AD-A081070; SU-SOL-79-23; ARO-16470.5-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

An algorithm is presented for adaptively partitioning a multidimensional coordinate space based on optimization of a scalar function of the coordinates. The goal is to construct a set of hyperrectangular regions, such that the variation of function values within each region is small. These regions are then used as the basis for a stratified sampling estimate of the definite integral of the function. GRA

N80-24062# Stanford Univ., Calif. Systems Optimization Lab.
A NOTE ON SPARSE QUASI-NEWTON METHODS
Mukund Thapa Sep. 1979 18 p refs
(Contracts DAAG29-79-C-0110; DE-AS03-76SF-00034; Grants NSF MCS-76-20019; NSF ENG-77-06761)
(AD-A081068; SU-SOL-79-13; ARO-16470.3-M) Avail: NTIS HC A02/MF A01 CSCL 12/1

Shanno's derivation of the sparse analog of any symmetric Quasi-Newton update is obtained as a simple extension of Toint's derivation of a sparse update. Furthermore, it is shown how to compute an intermediate quantity efficiently. GRA

N80-24063# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A NUMERICAL METHOD TO INTEGRATE STIFF SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
T. P. Coffee, J. M. Heimerl, and M. D. Kregel Jan. 1980 53 p refs
(DA Proj. 1L1-61102-AH-43)
(AD-A080998; AD-E430374; ARBRL-TR-02206) Avail: NTIS HC A04/MF A01 CSCL 12/1

A method is described for the efficient integration of stiff systems of ordinary differential equations. The method, based on a predictor-corrector formulation, uses the Jacobian in a non-standard fashion. The resulting program is compared with EPISODE, a standard stiff integrator, for a number of systems of ordinary differential equations. The results show that the procedure is usually competitive with EPISODE and is more efficient for some problems. GRA

N80-24064# California Univ., Livermore. Lawrence Livermore Lab.
LINEAR LEAST-SQUARES ANALYSIS AND EFFECTIVE INTERACTIONS
S. D. Bloom, R. F. Hausman, Jr. (LASL), and J. Larsen Mar. 1979 11 p Presented at the (P,N) Reaction and Nucleon-Nucleon Force Conf., Telluride, Colo., 29-31 Mar. 1979
(Contract W-7405-eng-48)
(UCRL-82587; CONF-790348-6) Avail: NTIS HC A02/MF A01

Some results are shown from the application of the method of singular value analysis (SVA), a particular form of linear squares analysis, to two sets of experimental two body matrix elements, the 63 Chung-Wildenthal matrix elements for the ld5/2, ld3/2 shells (A approx. equal to 20 to 40) and the best 84 matrix elements from previous work. The latter cover the atomic weight range of A approx. equal to 40 to 200 and nine shells from ld3/2 to lf3/2. The purpose is the extraction of a first-order set of strength parameters for an effective interaction of minimum rank and simple form for each set or both sets of data. The ranges, being nonlinear in their effects are investigated separately. Mainly considered are local potential forms, which is not a limitation of the approach. DOE

N80-24065# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
GLOBAL ERROR ESTIMATION FOR STIFF ODEs
L. F. Shampine Oct. 1979 20 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1587) Avail: NTIS HC A02/MF A01

A method is presented which in some generality, provides a rough estimate of the global error arising in the numerical solution of the initial-value problem for a stiff set of ordinary differential equations (ODEs). The procedure is not rigorously correct like global extrapolation, nor is its justification comparable to that of Stetter's scheme for Adams codes. There is a close relationship between the method and more specialized ones proposed by Robinson and Prothero, and Dew and West. A careful discussion of the most important approximations made in the present paper illuminates the accuracy and reliability of these other methods. DOE

N80-24066# Princeton Univ., N. J. Plasma Physics Lab.
SEPARATING VARIABLES IN TWO-WAY DIFFUSION EQUATIONS
N. J. Fisch and M. D. Kruskal Oct. 1979 43 p refs
(Contract EY-76-C-02-3073)
(PPPL-1596) Avail: NTIS HC A03/MF A01

It is shown that solutions to a class of diffusion equations of the two-way type may be found by a method akin to separation of variables. The difficulty with such equations is that the boundary data must be specified partly as initial and partly as final conditions. In contrast to the one way diffusion equation, where the solution separates only into decaying eigenfunctions, the two way equations separate into both decaying and growing eigenfunctions. Criteria are set forth for the existence of linear eigenfunctions, which may not be found directly by separating variables. A speculation with interesting ramifications is that the growing and decaying eigenfunctions are separately complete in an appropriate half of the problem domain. DOE

N80-24067# Sandia Labs., Albuquerque, N. Mex. Numerical Mathematics Div.
QUADRATURE SUBROUTINES FOR SPLINES AND B-SPLINES
Donald E. Amos Dec. 1979 12 p refs
(Contract EY-76-C-04-0789)
(SAND-79-1825) Avail: NTIS HC A02/MF A01

Four subroutines (BSQUAD, PPQUAD, BFQUAD, and PFQUAD) for integrating splines and B-splines are described. The subroutine BSQUAD accepts the B-representation in terms of the knot array T(*), the coefficient array BCOEF(*) the number of coefficients N, and the order K to compute integrals on subintervals of T(K) < or = X < or = T (N+1). Distinct knot partition the interval of integration so that polynomial integration by a Gauss quadrature formula can be implemented. The piecewise polynomial form is accepted by PPQUAD which sums polynomial evalation of integrals on the partition. More general integrals for the product of a function f(x) and a B-spline are computed similarly in subroutines BFQUAD and PFQUAD using a quadrature routine with error control and code structure similar to that in BSQUAD and PPQUAD. DOE

N80-24068# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
GENERATING ALL MAXIMAL INDEPENDENT SETS: NP-HARDNESS AND POLYNOMIAL-TIME ALGORITHMS
E. L. Lawler (California Univ., Berkeley), J. K. Lenstra, and A. H. G. Rinnooykan (Erasmus Univ.) Apr. 1978 18 p refs Sponsored in cooperation with Netherlands Organization for Advancement of Pure Research (ZWO) Submitted for publication
(Grant NSF MCS-76-17605)
(MC-BW-87/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2,88

Suppose that an independence system (E,I) is characterized by a subroutine which indicates in unit time whether or not a given subset of E is independent. It is shown that there is no algorithm for generating all the K maximal independent sets of such an independence system in time polynomial in the absolute value of E and K, unless P = NP. However, it is possible to apply ideas of Paull and Unger and of Tsukiyama et al. to obtain polynomial-time algorithms for a number of special cases, e.g., the efficient generation of all maximal feasible solutions to a knapsack problem. The algorithmic techniques bear an interesting relationship with those of Read for the enumeration of graphs and other combinatorial configurations. Author (ESA)

N80-24069# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
A NONLINEAR VECTOR FINITE DIFFERENCE SCHEME
Paul J. Schweitzer Jun. 1978 10 p refs Submitted for publication
(MC-BW-89/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A nonlinear vector iterative scheme of linear fractional form is investigated. Explicit expressions are given for each vector iterate and for the limiting vector. These equations arise in the bottleneck analysis of closed networks of queues. Author (ESA)

N80-24070# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
NON-STATIONARY MARKOV DECISION PROBLEMS WITH CONVERGING PARAMETERS
A. Federgruen (Rochester Univ.) and P. J. Schweitzer (Rochester Univ.) Aug. 1978 31 p refs Submitted for publication
(MC-BW-90/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The solution of Markov decision problems is discussed. Various models are presented in which this situation occurs. It is shown that a modified value-iteration method may be employed in order to solve the optimality equation and to find optimal policies. In both cases the convergence rate is shown to be geometric. The asymptotic behavior of backward products of a geometrically convergent sequence of Markov matrices is characterized. Author (ESA)

N80-24071# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
DENUMERABLES STATE SEMI-MARKOV DECISION PROCESSES WITH UNBOUNDED COSTS, AVERAGE COST CRITERION
A. Federgruen (Leiden Univ.), A. Hordijk, and H. C. Tijms (Vrije Univ.) Sep. 1978 24 p refs Submitted for publication
(MC-BW-92/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

An undiscounted semi-Markov decision model with a denumerable state space and compact metric action sets, where the one step expected costs and transition times are allowed to be unbounded, is discussed. The existence of a finite solution to the average costs optimality equation is verified as well as the existence of an average cost optimal stationary policy. Author (ESA)

N80-24072# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
ANALYSIS OF HEURISTICS FOR SEQUENCING JOBS ON ONE MACHINE WITH RELEASE DATES AND DELIVERY TIMES
C. N. Potts (Keele Univ.) Nov. 1978 13 p refs Submitted for publication
(MC-BW-95/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 6

The single machine sequencing problem is considered in which each job has a release date, a processing time, and a delivery time. The objective is to find a sequence of jobs which minimizes the time by which all jobs are delivered. A heuristic is presented which never deviates by more than 50 percent from the optimum. Author (ESA)

N80-24073# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ONE-STEP SPLITTING METHODS FORMULATED FOR SEMI-DISCRETE PARABOLIC EQUATIONS
P. J. vanderHouwen and J. G. Verwer Apr. 1978 34 p refs Submitted for publication
(MC-NW-55/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3,85

Splitting methods for parabolic equations via the method of lines are discussed, starting with the formulation of these methods for semi-discrete equations such as dy/dt = f(y), f non-linear,

and f satisfying a linear splitting relation f(y) = sum of f sub i(y). A class of one-step integration formulas is defined, which is shown to contain all known splitting methods, provided the functions F sub i are defined appropriately. For a number of methods stability results are given. Secondly, attention is paid to alternating direction methods for problems with an arbitrary nonlinear coupling between space derivatives. Numerical results of those methods are compared with results obtained by a hopscotch method. Author (ESA)

N80-24074# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
SEMI-DISCRETIZATION METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS ON NONRECTANGULAR GRIDS
K. Dekker May 1978 26 p refs Submitted for publication
(MC-NW-56/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A semi-discretization method for two dimensional partial differential equations is presented, applicable to curvilinear meshes. The method yields nine-point approximation formulas for the first and second derivatives of a function. Error estimates for another discretization method are given, and both methods are compared in numerical examples. The new method turns out to be more accurate, whereas the calculation of the weights of the formulas is more time-consuming. Author (ESA)

N80-24075# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
THE APPLICATION OF ITERATED DEFECT CORRECTION TO THE LOD METHOD FOR PARABOLIC EQUATIONS
J. G. Verwer Aug. 1978 33 p refs Submitted for publication
(MC-NW-58/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

The numerical solution of the initial boundary value problem for a class of multi-dimensional parabolic partial differential equations is studied. In particular the time-integration of semi-discrete equations is investigated. An attempt is made to develop integration formulas which are computationally attractive and of high accuracy, while possessing unconditional stability properties. To that end iterated defect correction is applied to the LOD method. The convergence properties of this process are investigated. Numerical experiments are reported.
Author (ESA)

N80-24076# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE STABILITY OF MULTISTEP FORMULAS FOR VOLTERRA INTEGRAL EQUATIONS OF THE SECOND KIND
P. J. vanderHouwen and P. H. M. Wolkenfelt Aug. 1978 21 p refs Submitted for publication
(MC-NW-59/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The stability properties of a class of multistep methods for second kind Volterra integral equations are analyzed. The usual analysis in which the kernel function is a priori restricted to a special class of test functions is followed. In most stability investigations these test functions depend only on the unknown function. In this case it is only required that the kernel function can be separated with respect to its first argument. Stability conditions are derived. It turns out that in the case of linear convolution kernels, the trapezoidal rule may become unstable.
Author (ESA)

N80-24077# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ERROR BOUNDS FOR EXPONENTIALLY FITTED GALERKIN METHODS APPLIED TO STIFF TWO-POINT BOUNDARY VALUE PROBLEMS
P. P. N. deGroen and P. W. Hemker Sep. 1978 35 p refs Submitted for publication
(MC-NW-62/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

A linear second order singularly perturbed two point boundary-value problem is considered. Discretization by means of Petrov-Galerkin methods of finite element type, where the trial spaces contain piecewise exponentials, is studied. Error bounds, both pointwise and in the energy norm, are derived. The relation with other special difference schemes is shown and the error bounds obtained are compared with numerical results.
Author (ESA)

N80-24078# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
ON THE STABILITY OF MULTISTEP FORMULAS FOR SYSTEMS OF VOLTERRA INTEGRO-DIFFERENTIAL EQUATIONS
P. J. vanderHouwen, H. J. J. teRiele, and P. H. M. Wolkenfelt Oct. 1978 44 p refs Submitted for publication
(MC-NW-63/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

The stability behavior of linear multistep methods is analyzed for systems of integro-differential equations of Volterra type which are only restricted by the condition that the kernel function is finitely decomposable. Stability regions are derived for backward differentiation type schemes of orders 2 up to 6 and for the trapezoidal rule. In particular, attention is paid to these schemes when applied to the special integro-differential equation, which arises from differentiating a Volterra integral equation of the second kind. Numerical experiments are reported which confirm the theoretical stability results. Author (ESA)

N80-24079# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Numerical Mathematics.
COMPUTATIONS CONCERNING THE CONJECTURE OF MERTENS
H. J. J. teRiele Dec. 1978 9 p refs Submitted for publication
(MC-NW-64/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

In 1897, F. Mertens conjectured that the absolute value of M (x) is less than the square root of x, for all real x greater than 1, where M (x) = Sigma sub n less than or = x mu(n), and mu is the Moebius function. Several hundred hours of CPU time of a CDC Cyber 73/173 computer system were used to prove that the absolute value of M (x) greater than 0.860 square root of x, for some real x greater than 1. Author (ESA)

N80-24080# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
INEQUALITIES IN DISCRETE DISTRIBUTIONS
J. M. Buhrman Apr. 1978 12 p Submitted for publication
(MC-SW-56/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 2.88

Sufficient conditions were derived for the implication F sub 1 (x) less than or = F sub 2 implies F sub 1 (x-j) less than or = F sub 2 (x-j) for all j greater than zero where F sub 1 and F sub 2 are discrete distribution functions with jumps on Z. Results are given for pairs of possibly shifted - distribution functions of binomial, Poisson, hypergeometric and negative binomial type.
Author (ESA)

N80-24081# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
A NOTE ON THE MEDIAN OF THE BINOMIAL DISTRIBUTION
R. Kaas and J. M. Buhrman Jul. 1978 11 p refs Submitted for publication
(MC-SW-59/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The location of the median of the binomial distribution is studied. An integer k is shown to be a median of the binomial-(n,p) distribution if it does not differ from np by more than min (p,1-p). Neither the inequality 'mean less than median less than mode' nor its reverse holds if median and mode differ. Author (ESA)

N80-24082# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
NONUNIFORMITY OF THE CONVERGENCE OF LOCATION ESTIMATORS
C. A. J. Klaassen Oct. 1978 11 p refs Submitted for publication
(MC-SW-60/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The pointwise supremum is considered of the distribution

functions of properly normed translation equivariant antisymmetric location estimators based on observations from a distribution with a symmetric density. For positive values of the argument this function converges to the standard normal distribution function as the number of observation increases. Sets of symmetric densities are given over which this convergence, and consequently the convergence of adaptive location estimators, is not uniform.
Author (ESA)

N80-24083# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
REGRESSION ANALYSIS FOR MIXED CROSS-SECTION AND TIME-SERIES DATA WITH REFERENCES TO SOME INCOMPLETE OBSERVATIONS TECHNIQUES
R. D. Gill Nov. 1978 28 p refs Submitted for publication (MC-SW-61/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

An iterative method is proposed for estimating a certain regression model with mixed cross section and time series data, where each observational unit is not necessarily available at each time point of the time series. Consistency and asymptotic normality of the estimators of the regression coefficients is proved as the size of the cross section increases while the length of the time series remains bounded. Both other models and the connection between this method and various incomplete data techniques from the literature are discussed. Author (ESA)

N80-24084# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
THE EFFICIENCY OF THREE TESTS FOR LINEAR HYPOTHESES CONCERNING TWO PROBABILITIES
J. M. Buhrman Nov. 1978 12 p refs Submitted for publication
(MC-SW-62/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Two experiments have probabilities of success: p sub 1 and p sub 2 respectively. Three methods are described to test hypotheses with the form p sub 1 - cp sub 2 = d, and their Pitman-efficiencies are given. Author (ESA)

N80-24085# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
JACOBI FUNCTIONS: THE ADDITION FORMULA AND THE POSITIVITY OF THE DUAL CONVOLUTION STRUCTURE
M. Flensted-Jensen (Copenhagen Univ.) and T. H. Koornwinder May 1978 21 p refs Sponsored in part by Dan. Nat. Sci. Res. Council Submitted for publication
(MC-TW-177/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum Amsterdam FL 3

An addition formula for Jacobi functions phi sub lambda (alpha, beta) (alpha greater or = beta greater or = -1/2) analogous to the known addition formula for Jacobi polynomials is proven. The positivity of the coefficients in the addition formula is exploited by giving the following application. It is proven that the product of two Jacobi functions of the same argument has a nonnegative Fourier-Jacobi transform. This implies that the convolution structure associated to the inverse Fourier-Jacobi transform is positive. Author (ESA)

N80-24086# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
A FRACTIONAL INTEGRAL OPERATOR CORRESPONDING TO NEGATIVE POWERS OF A CERTAIN SECOND ORDER DIFFERENTIAL OPERATOR
I. G. Sprinkhuizen-Kuijper Aug. 1978 40 p refs Submitted for publication
(MC-TW-182/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 5

A class of integral operators is defined which contains negative fractional powers of both D squared/DX squared + (V/X x D/DX) and (I/X x D/DX). These operators are intimately connected with an integral formula for hypergeometric functions due to Erd elyi. A result of Wimp on hypergeometric integral equations is also contained in the theory of these fractional integral operators. Author (ESA)

N80-24087# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
ON A CLASS OF ELLIPTIC SINGULAR PERTURBATIONS WITH APPLICATIONS IN POPULATION GENETICS
J. Grasman Oct. 1978 15 p refs Submitted for publication (MC-TW-184/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

With the maximum principle for differential equations asymptotic estimates are made for a class of linear elliptic singular perturbation problems with resonant turning point behavior in some of the independent variables. The method is applied to stationary solutions of the Kolmogorov backward equation from population genetics. Author (ESA)

N80-24088# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
ON THE EDGE-COLORING PROPERTY FOR THE HEREDITARY CLOSURE OF A COMPLETE UNIFORM HYPERGRAPH 2
R. Tijdeman Apr. 1978 8 p ref Submitted for publication (MC-ZW-106/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 6

It is shown that the collection of subsets of cardinality at most h of a fixed set of cardinality n possesses a parallelism (1-factorization) if n = kh-1, h is odd, and 1/2 (h+1) less than or = k less than or = h-4 thereby completing results of A.E. Brouwer. Author (ESA)

N80-24089# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
VERTEX-CRITICAL SUBGRAPHS OF KNESER-GRAPHS
A. Schrijver Feb. 1978 11 p refs Submitted for publication (MC-ZW-108/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is shown that if the stable (indapendent) n-subsets of a circuit with 2n+k vertices are split into k+1 classes, one of the classes contains two disjoint n-subsets; this yields a (k+2)-vertex-critical subgraph of Lovasz' Kneser-graph KG sub n,k. Author (ESA)

N80-24090# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
A LOWER BOUND FOR THE LENGTH OF PARTIAL TRANSVERSALS IN A LATIN SQUARE
A. E. Brouwer, A. J. deVries (Eindhoven Univ., Netherlands), and R. M. A. Wieringa (Eindhoven Univ., Netherlands) Feb. 1978 8 p refs Submitted for publication
(MC-ZW-109/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is proven that any Latin square of order n has a partial transversal or order at least n-square root of N. Author (ESA)

N80-24091# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
SOLUTION OF TWO FRACTIONAL PACKING PROBLEMS OF LOVASZ
A. Schrijver and P. D. Seymour (Merton Coll.) Apr. 1978 12 p refs Submitted for publication
(MC-ZW-110/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Lovasz asked whether the following is true for each hypergraph H and natural number k: if epsilon sub k (H prime) = k. Epsilon * (H prime) holds for each hypergraph H prime arising from H by multiplication of points, then epsilon sub k (H) = tau sub k (H); and if tau sub k (H prime) = k. tau * (H prime) holds for each hypergraph H prime arising from H by removing edges, then tau sub k (H) = epsilon sub k (H). A proof and generalization are given for the former, and a counter example is provided for the latter. Author (ESA)

N80-24092# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
A LOWER BOUND FOR THE PERMANENTS OF CERTAIN (0,1)-MATRICES
M. Voorhoeve Apr. 1978 8 p refs
(MC-ZW-111/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is proven that the permanent of a nxn (0,1)-matrix with

exactly three ones in each row and column is at least 6 (4/3) to the n-3 power for n > or = 3. Author (ESA)

N80-24093# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
BINARY CODES WITH MINIMUM DISTANCE FOUR
M. R. Best Aug. 1978 30 p refs Submitted for publication
(MC-ZW-112/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 4

A binary code with length ten and minimum Hamming distance four is presented. It contains forty words, and is therefore optimal. It gives rise to a new sphere packing in ten dimensions. It is proven that a binary code of length eleven and minimum distance four cannot contain eighty words. All seventeen optimal codes with length twelve, constant weight four and minimum distance four are listed. Author (ESA)

N80-24094# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
ON THE DIOPHANTINE EQUATION 1k + 2k + ... + xk + R(x) = yz
M. Voorhoeve, K. Gyoery, and R. Tijdeman Aug. 1978 14 p refs Submitted for publication
(MC-ZW-113/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The following theorem is proven: let R(x) be a fixed polynomial with rational integer coefficients; let b not = o and k > or = 2 be fixed rational integers such that k does not belong to the interval (3,5); then the equation 1k + 2k + ... + xk + R (x) = byz in integers x, y, > or = to 1 and 2 > 1 has only finitely many solutions. Author (ESA)

N80-24095# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
A GENERALIZATION OF DECARTES' RULE
M. Voorhoeve Oct. 1978 15 p refs Submitted for publication
(MC-ZW-115/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A generalization of Descartes' rule is presented and analyzed. The generalization is not limited to exponential sums and integrals. An example using the Dirichlet series is presented to show this. Author (ESA)

N80-24096# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
INTERPOLATION FOR FRAGMENTS OF THE PROPOSITIONAL CALCULUS
J. I. Zucker Nov. 1978 21 p refs Submitted for publication
(MC-ZW-116/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The problem of whether the interpolation theorem holds for arbitrary fragments of classical and intuitionistic propositional calculus, is considered. Author (ESA)

N80-24097# European Space Agency, Paris (France).
THE ROBERSON/WITTENBURG FORMALISM AND THE PACKAGE MULTIBODY FOR COMPUTER SIMULATIONS OF MULTIBODY SYSTEMS
Richard Schwertassek Nov. 1979 145 p refs Transl. into ENGLISH of "Der Roberson/Wittenburg-Formalismus und das Programmsystem MULTIBODY zur Rechnersimulation von Mehrkoerpersystemen", Rept. DFVLR-FB-78-08 DFVLR, Oberpfaffenhofen, West Germany, May 1978 Original report in GERMAN previously announced as N79-30979
(ESA-TT-557; DFVLR-FB-78-08) Avail: NTIS HC A07/MF A01; ZLDI, Munich DM 49,70

The prediction of the dynamic behavior of multibody systems (MBS) is based on computer oriented multibody formalisms. The corresponding computer programs prove to be an efficient tool for treating a great variety of problems. Their broad field of application results from consistent use of the capacity of modern computers. The equations of motion are established by the computer itself, starting from input data, which may be derived easily by the user. The kinematic and dynamic equations of MBS are presented in scalar, computer oriented form. These equations are implemented in the multipurpose computer package MULTIBODY. Its characteristics are demonstrated by considering an example from a typical field of application, such as the simulated deployment of the solar arrays of a geostationary communication satellite. Author (ESA)

N80-24098# European Space Agency, Paris (France).
THEORY AND NUMERICAL METHODS OF RESOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS
Pierre Laval Apr. 1980 206 p refs Transl. into ENGLISH of "Theorie et Methodes Numeriques de Resolution des Equations aux Derivees Partielles", Rept. ONERA-NT-1979-2 ONERA, Paris, 1979 Original report in FRENCH previously announced as N80-23073
(ESA-TT-606; ONERA-NT-1979-2) Avail: NTIS HC A10/MF A01

The general properties and the classification of second order partial differential equations are presented as well as systems of higher order. The various classical boundary problems, whether hyperbolic, parabolic or elliptic, are then given in the simple case of the wave, heat and Laplace equations with two independent variables. The finite element method is discussed in terms of two dimensional elliptic or three dimensional parabolic problems. The finite difference methods of pseudo viscosity are evaluated for problems of unsteady compressible flows with shock waves. The implicit splitting up methods (of stabilization, predictor-corrector and desintegration) are formulated for evolution problems. The stabilization method is described for elliptic problems after a review of some iterative methods.Author (ESA)

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N80-24099*# National Aeronautics and Space Administration. Hugh L. Dryden Flight Research Center, Edwards, Calif.
BIVARIATE NORMAL, CONDITIONAL AND RECTANGULAR PROBABILITIES: A COMPUTER PROGRAM WITH APPLICATIONS
Ram Swaroop, James D. Brownlow, George R. Ashwworth, and William R. Winter May 1980 39 p Prepared jointly with Systems Development Corp., Edwards, Calif.
(NASA-TM-81350) Avail: NTIS HC A03/MF A01 CSCL 12A

Some results for the bivariate normal distribution analysis are presented. Computer programs for conditional normal probabilities, marginal probabilities, as well as joint probabilities for rectangular regions are given: routines for computing fractile points and distribution functions are also presented. Some examples from a closed circuit television experiment are included. M.G.

N80-24100# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
THE METHOD OF n RANKINGS WHEN THE UNDERLYING DISTRIBUTIONS ARE DISCRETE Ph.D. Thesis
R. Markham Jul. 1979 245 p refs
(CSIR-TWISK-108) Avail: NTIS HC A11/MF A01

The problem of testing the null hypothesis of equal treatment effects, H sub O, in a block design, is studied. Three classes of rank tests are considered, the class of average scores tests, of midrank scores tests, and of randomized ranks tests. The randomized block design, and the balanced incomplete randomized block design are considered as special cases. Special cases of the rank tests are compared with the parametric test by means of their asymptotic relative efficiencies. An asymptotic comparison is also made of the three classes of rank tests. A method is provided for the calculation of the exact powers of the rank tests and several relative efficiency curves are calculated. E.D.K.

N80-24101# Florida State Univ., Tallahassee. Dept. of Statistics.
ON THE CHOICE OF VARIANCE FOR THE LOG RANK TEST Interim Report
Mark Brown Nov. 1979 26 p refs
(Contract F49620-79-C-0157; AF Proj. 2304)
(AD-A080296; FSU-STATISTICS-M528; TR-79-B3-AFOSR;

AFOSR-80-0068TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

The log rank test is widely used for comparison of survival curves. This paper examines various estimators for the variance of the log rank test statistic. These include the Mantel-Haenszel variance, the permutation variance of Peto and Peto and several newly proposed estimators. The results generalize to a wide class of test statistics for the two sample problems with censored data. GRA

N80-24102# North Carolina Univ. at Chapel Hill. Inst. of Statistics.

SAMPLING REPRESENTATIONS AND APPROXIMATIONS FOR CERTAIN FUNCTIONS AND STOCHASTIC PROCESSES Interim Report

Muhammad Kamel Habib Jan. 1980 102 p refs

(Grant AF-AFOSR-2796-75; AF Proj. 2304)

(AD-A081533; MMS-1260; AFOSR-80-0141TR) Avail: NTIS HC A06/MF A01 CSCL 12/1

Sampling representations and approximations of deterministic and random signals are important in communication and information theory. Finite sampling approximations are derived for certain functions and processes which are not bandlimited, as well as bounds on the approximation errors. Also derived are sampling representations for bounded linear operators acting on certain classes of bandlimited functions and processes; these representations enable one to reconstruct the image of a function (or a process) under a bounded linear operator using the samples of the image. Finally, sampling representations for distributions and random distributions are obtained. GRA

N80-24103# Wisconsin Univ. - Madison. Dept. of Statistics.

ON THE PERFORMANCE OF LEAST SQUARES ESTIMATORS IN TYPE TWO CENSORED ACCELERATED LIFE TESTS

G. K. Bhattacharyya and Z. Soejoeti Aug. 1979 13 p refs

(Contract N00014-78-C-0722)

(AD-A080912; UWIS-DS-79-576) Avail: NTIS HC A02/MF A01 CSCL 14/4

In context of the analysis of accelerated life testing experiments where items are tested under more severe stress conditions than those arising in normal use, the least squares approach is noted for its simplicity. Expressions are derived for the asymptotic efficiency of the least squares estimators when the failure time data are type II censored. Applications of the general results are made to the Weibull and exponential models and the loss of efficiency is investigated in relation to the severity of censoring and the nature of spread of the design points. GRA

N80-24104# Wisconsin Univ. - Madison. Dept. of Statistics.

TRANSFORMATION OF A DISCRETE DISTRIBUTION TO NEAR NORMALITY

Fabian Hernandez and Richard A. Johnson Nov. 1979 12 p refs

(Contract N00014-78-C-0722)

(AD-A080886; UWIS-DS-79-546) Avail: NTIS HC A02/MF A01 CSCL 12/1

Utilizing an information number approach, we propose an objective method for the normalization of either discrete distributions, or sample counts, by means of a power transformation. Approximations are also given to the original known probabilities. Next, we derive the large sample distribution of our estimate of the power transformation. We compare our methods with the Box-Cox procedure, applied to observed counts, and conclude that their technique often provides good approximations even though their underlying assumption of normality is clearly violated. Two examples illustrate our methods. GRA

N80-24105# Wisconsin Univ. - Madison. Dept. of Statistics.

THE SELECTION OF AN EXTREME-VALUE DISTRIBUTION

Fabian Hernandez and Richard A. Johnson Apr. 1979 16 p refs

(Contract N00014-78-C-0722)

(AD-A080884; UWIS-DS-79-544) Avail: NTIS HC A02/MF A01 CSCL 12/1

We consider the problem of transforming a known distribution (or a random sample) to distributions other than the normal. Transformations to the negative exponential distribution are considered but the most interesting version is the extension concerning the selection of a best fitting extreme value distribution. By creating a suitable three parameter family of transformations all three types of extreme value distributions may be considered as candidates. Our sample approach to the selection is based on the marginal posterior distribution of the shape parameter. GRA

N80-24106# Wisconsin Univ. - Madison. Dept. of Statistics.

THE LARGE SAMPLE BEHAVIOR OF TRANSFORMATIONS TO NORMALITY

Fabian Hernandez and Richard A. Johnson Jan. 1979 22 p refs

(Contract N00014-78-C-0722)

(AD-A080885; UWIS-DS-79-545) Avail: NTIS HC A02/MF A01 CSCL 12/1

We investigate the large sample behavior of both the classical and Bayesian procedures for selecting a transformation to normality. The study of the large sample behavior clearly reveals the role played by the assumptions leading to the Box and Cox procedures. Based on our large sample results, we introduce an information number approach for transforming a known distribution to near normality. This latter procedure provides bench marks for the maximum possible amount of improvement through power transformations. We illustrate our procedure with three examples. Finally, we generalize our procedure to random vectors and linear models situations. GRA

N80-24107# Pittsburgh Univ., Pa. Dept. of Mathematics and Statistics.

MAXIMUM LIKELIHOOD ESTIMATION FOR AN AUTOREGRESSIVE PROCESS WITH MISSING OBSERVATIONS

Suan-Boon Tan Aug. 1979 13 p refs

(Contract N00014-76-C-0839)

(AD-A081251) Avail: NTIS HC A02/MF A01 CSCL 12/1

Three methods are proposed for estimation of the parameters of an autogressive process of order p with missing observations. These methods are based on the maximum likelihood approach and use the EM algorithm, the Newton-Raphson method and the method of scoring, which are applied to the likelihood equations. Finally, comparison on those methods is also discussed. GRA

N80-24108# Georgia Inst. of Tech., Atlanta. School of Information and Computer Science.

COMBINATORIAL GRAPH EMBEDDING Final Report

R. A. Demillo, S. C. Eisenstat, and R. J. Lipton Jan. 1980 85 p refs

(Grant DAAG29-76-G-0338)

(AD-A081247; GIT-ICS-79/12; ARO-14690.10-EL) Avail: NTIS HC A05/MF A01 CSCL 12/1

Let G, G' be directed graphs. A combinatorial embedding of G into G' is an identification of each x an element of V(G) with a set of vertices S a subset of V(G') such that each S is bounded in size by a constant independent of -V(G)- and each arc in G is carried into a directed path of length bounded by a constant independent of -V(G)-. This concept has formed the basis for a number of theoretical studies and the papers collected here are representative of - with one major exception - the state-of-the-art with regard to graph embedding. GRA

N80-24109# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.

STOCHASTIC FILTERING THEORY: A DISCUSSION OF CONCEPTS, METHODS, AND RESULTS

J. H. vanSchuppen Dec. 1978 21 p refs Submitted for publication

(MC-BW-96/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The stochastic filtering problem is examined and a definition proposed for a stochastic dynamical system in terms of the conditional independence relation. The stochastic filtering problem is then defined as the determination of the conditional distribution of the state given past observations. Two methods to solve this problem are sketched. A list with stochastic dynamical systems for which the stochastic filtering problem has been resolved is given, and some examples are presented. Author (ESA)

N80-24110# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
TESTING WITH REPLACEMENT AND THE PRODUCT LIMIT ESTIMATOR
R. D. Gill May 1978 26 p refs Submitted for publication
(MC-SW-57/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Let X1, X2,... be a sequence of i.i.d. strictly positive random variables with distribution function F. Define N tilde (t) = the number of j with X sub 1 +...+ X sub j < or = to t. In testing with replacement, n independent copies of N tilde are observed each over the time interval (o,T) and the interest lies in nonparametric estimation of F based on these observations. Consistency is proven of the product limit estimator as n goes to infinity for arbitrary F, and weak convergence for two cases: integer valued X sub i and X sub i with a continuous distribution function. The theory of stochastic integrals is used to do this, and the similarity of the results is explained with those for the product limit estimators in the model of random censorship.
Author (ESA)

N80-24111# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
BOUNDS FOR THE MEAN AND STANDARD DEVIATION OF LINEAR COMBINATIONS OF ORDER STATISTICS
Charles H. Kraft and Constance vanEeden Jun. 1978 20 p Submitted for publication Sponsored in part by Quebec Min. of Educ.
(Grants NRC-A-3038; NRC-A-3114)
(MC-SW-58/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Bounds are given for E sub theta Sigma from s = 1 to s = N alpha sub s o sub s and sigma sub theta (Sigma from s = 1 to s = N alpha sub s o sub s), where o sub 1,..., o sub N are the order statistics of X sub 1,..., X sub N, a random vector with density p sub o (x sub 1 - theta sub 1,..., x sub N - theta sub N) for some theta = (theta sub 1,..., theta sub N) and p sub o (x sub 1,..., x sub N) a completely arbitrary density with respect to Lebesgue measure in R sub N. If the X sub i are exchangeable under p sub o the bounds depend only on E sub o Sigma from s=1 to s=N alpha sub s o sub s and sigma sub o (Sigma from s=1 to s=N alpha sub s o sub s plus quantities that can be computed without knowledge of p sub o. The bounds are attainable for some distributions and nearly attainable for some others.
Author (ESA)

N80-24112# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
LARGE DEVIATIONS OF MULTIVARIATE-L-ESTIMATORS WITH MONOTONE WEIGHT FUNCTIONS
J. Oosterhoff Dec. 1978 15 p refs Submitted for publication
(MC-SW-63/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A large deviation theorem for p-variate (p greater than or = 1) linear combinations of order statistics with monotone weight functions is derived. The proof is based on a Sanov-type large deviation results for empirical common distribution functions.
Author (ESA)

N80-24113# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Mathematical Statistics.
NONPARAMETRIC ESTIMATION BASED ON CENSORED OBSERVATIONS OF A MARKOV RENEWAL PROCESS
R. D. Gill Dec. 1978 30 p refs Submitted for publication
(MC-SW-64/78) Avail: NTIS HC A03/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Uniform consistency and weak convergence is proved for estimators of the transition probabilities of an arbitrary finite state space Markov renewal process, based on n independent and identically distributed right censored realizations of the process. The approach uses the theory of stochastic integrals and counting processes. It is shown how the results may be extended to the non-identically distributed case and to general censorship under suitable conditions.
Author (ESA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N80-24114*# Johns Hopkins Univ., Baltimore, Md. Dept. of Electrical Engineering.
INTERMITTENT/TRANSIENT FAULTS IN COMPUTER SYSTEMS: EXECUTIVE SUMMARY
Gerald M. Masson Apr. 1980 39 p refs
(Grant NsG-1442)
(NASA-CR-159229) Avail: NTIS HC A03/MF A01 CSCL 09B

An overview of an approach for diagnosing intermittent/transient (I/T) faults is presented. The development of an interrelated theory and experimental methodology to be used in a laboratory situation to measure the capability of a fault tolerant computing system to diagnose I/T faults, is discussed. To the extent that such diagnosing capability is important to reliability in fault tolerant computing systems, this theory and supporting methodology serves as a foundation for validation efforts.
E.D.K.

N80-24115# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
AN ADAPTIVE BRANCHING RULE FOR THE PERMUTATION FLOW-SHOP PROBLEM
C. N. Potts (Keele Univ.) Sep. 1978 16 p refs Submitted for publication
(MC-BW-91/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A branch and bound algorithm is presented for the permutation flow-shop problem in which the objective is to minimize the maximum completion time. A branching procedure is used in which jobs both at the beginning and at the end of the schedule are fixed. Dominance rules are included in the algorithm. During the initial stages of the algorithm, upper bounds are computed at certain nodes of the search tree. Computational results indicate that the proposed algorithm is superior to previously published algorithms.
Author (ESA)

N80-24116# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Operations Research.
DETERMINISTIC PRODUCTION PLANNING: ALGORITHMS AND COMPLEXITY
M. Florian (Montreal Univ.), J. K. Lenstra, and Rinnooy A. H. G. Kan (Erasmus Univ.) Oct. 1978 16 p refs Co-sponsored by Netherlands Organ. for Advan. of Pure Res. (ZWO) and Natl. Res. Council of Canada Submitted for publication
(MC-BW-93/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

A class of production planning problems is considered in which known demands have to be satisfied over a finite interval at minimum total costs. For each period, production and storage cost functions are specified. The production costs may include setup costs and the production levels may be subject to capacity limits. The computational complexity of the problems in this class is investigated. Several algorithms proposed for their solution are described and analyzed. It is also shown that some special cases are NP-hard and hence unlikely to be solvable in polynomial time.
Author (ESA)

N80-24117# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Applied Mathematics.
RUN FOR YOUR LIFE. A NOTE ON THE ASYMPTOTIC SPEED OF PROPAGATION OF AN EPIDEMIC
O. Diekmann May 1978 24 p refs Submitted for publication
(MC-TW-176/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

The large-time behavior of the solution of a nonlinear integral equation of mixed Volterra-Fredholm type describing the spatio-temporal development of an epidemic is studied. For this model it is known that there exists a minimal wave speed c sub o (i.e., traveling wave solutions with speed c exist if the absolute value of c is greater than c sub o and do not exist if the absolute value of c is less than c sub o). It is shown that c sub o is the asymptotic speed of propagation (i.e., for any c

sub 1, c sub 2 with o less than c sub i less than c sub o less than c sub 2 the solution tends to zero uniformly in the region absolute value of x greater than or = to c sub 2 t, whereas it is bounded away from zero uniformly in the region absolute value of x less than or = to c sub 1 t for t sufficiently large).
Author (ESA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N80-24118# National Research Inst. for Mathematical Sciences, Pretoria (South Africa).
REGULARIZATION AND GENERALIZED INVERSE SOLUTIONS OF INTEGRAL EQUATIONS OF THE FIRST KIND IN REPRODUCING KERNEL HILBERT SPACES
M. L. Baart Jun. 1979 15 p refs
(CSIR-TWISK-98) Avail: NTIS HC A02/MF A01

An assessment is made of possible ways of presenting ill-posed problems, in this case typified by Fredholm integral equations of the first kind, in a reproducing kernel Hilbert space setting. Advantages of this kind of representation are discussed.
Author

N80-24119# George Washington Univ., Washington, D. C.
LOCATING AN ISOLATED GLOBAL MINIMIZER OF A CONSTRAINED NONCONVEX PROGRAM
Garth P. McCormick Sep. 1979 23 p refs
(Contract N00014-75-C-0729; Grant AF-AFOSR-2504-73)
(AD-A080180; SERIAL-T-409) Avail: NTIS HC A02/MF A01 CSCL 12/1

Conditions are given which verify the existence and determine the location of an isolated local constrained minimizer in a convex compact set. An exact formula is given for the amount by which the value of the objective function at some point differs from the value at that isolated point. Further conditions are given which ensure that the local minimizer is a global minimizer in the given convex compact set.
GRA

N80-24120# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE STRENGTH OF NONSTATIONARY INERATION Interim Report
G. W. Wasilkowski Aug. 1979 30 p refs
(Contract N00014-76-C-0370; Grant NSF MCS-75-22255; NR Proj. 044-422)
(AD-A081450; CMU-CS-79-138) Avail: NTIS HC A03/MF A01 CSCL 12/1

This is the second of three papers in which we study global convergence of iterations using linear information for the solution of nonlinear equations. In Wasilkowski we proved that for the class of all analytic scalar complex functions having only simple zeros there exists no globally convergent stationary iteration using linear information. Here we exhibit a nonstationary iteration using linear information which is globally convergent even for the multivariate and abstract cases. This demonstrates the strength of nonstationary iteration. In Wasilkowski we shall prove that any globally convergent iteration using linear information has infinite complexity even for the class of scalar complex polynomials having only simple zeros.
GRA

N80-24121# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
DISJOINTNESS AND QUASIFACTORS IN TOPOLOGICAL DYNAMICS
J. C. S. P. vanderWoude Nov. 1978 24 p refs Submitted for publication
(MC-ZW-119/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

Some results are presented about the disjointness relations between factors, extensions and quasifactors of minimal topological transformation groups (ttg's) with arbitrary phase group and compact Hausdorff phase space. Some families of minimal ttg's are characterized whose members are disjoint from a certain collection of minimal ttg's. For instance it is proven that if the phase group is strongly amenable, then the minimal ttg's, which are disjoint from every PI-ttg, are just the weakly mixing ones.
Author (ESA)

N80-24122# Stichting Mathematisch Centrum, Amsterdam (Netherlands). Dept. of Pure Mathematics.
ON A SUFFICIENT CONDITION FOR THE EXISTENCE OF G-COMPACTIFICATIONS
H. Ludescher (Polytech. Inst. Timisoara, Romania) and A. J. deVries Dec. 1978 11 p refs Submitted for publication
(MC-ZW-120/78) Avail: NTIS HC A02/MF A01; Stichting Math. Centrum, Amsterdam FL 3

It is shown that if a topological transformation group is pointwise equicontinuous with respect to some uniformity of the phase space, then it can equivariantly be embedded in a topological transformation group with a compact phase space and the same acting group.
Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N80-24123# Air Force Geophysics Lab., Hanscom AFB, Mass.
EMISSION OF PARTICLES FROM A CHARGED SPHERE INTO A MAGNETIC FIELD Interim Report
Christopher Sherman 20 Sep. 1979 14 p refs
(AF Proj. 7661)
(AD-A081781; AFGL-TR-79-0211; AFGL-ERP-674) Avail: NTIS HC A02/MF A01 CSCL 04/1

Trajectories of particles emitted normally from a charged sphere into a constant magnetic field are examined. Calculations are made which separate such trajectories into two classes: those that return to the sphere and those that do not.
GRA

N80-24124*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARISON OF INTERCONTINENTAL CLOCK SYNCHRONIZATION BY VLBI AND THE NTS SATELLITE Final Report
James A. Buisson (NRL), O. Jay Oaks, Jr. (NRL), Thomas B. McCaskill (NRL), William J. Hurd (JPL), Schulyer C. Wardrip, Hugh E. Warren (Bendix Field Eng. Corp., Columbia, Md.), and Gary G. Whitworth (APL) 4 Jan. 1980 9 p refs
(NRL Proj. R04-16)
(NASA-TM-81063; AD-A081001; AD-E000360; NRL-8366) Avail: NTIS HC A02/MF A01 CSCL 14/2

The intercontinental clock synchronization capabilities of Very Long Baseline Interferometry (VLBI) and the Navigation Technology Satellite (NTS) have been compared at the NASA Deep Space Net complexes at Madrid, Spain and Goldstone, California. The VLBI experiments used the Wideband VLBI Data Acquisition System developed at the NASA Jet Propulsion Laboratory. The Naval Research Laboratory NTS Satellites were used with NTS Time Transfer Receivers developed by the Goddard Space Flight Center. The two methods agreed to within about 0.5 microseconds.
GRA

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N80-24125 Stanford Univ., Calif.
SIGNAL PROCESSING FOR HIGHER FREQUENCY ULTRASONIC IMAGING Ph.D. Thesis
Douglas Baxter Boyle 1980 118 p
Avail: Univ. Microfilms Order No. 8011612

The use of signal processing methods in medical ultrasonic imagery is discussed. A high speed data acquisition system is used to record signals for subsequent computer analysis. A model of the normal heart is developed. The emphasis is on the frequency dependence of the scattering properties. The reflection coefficient,

acoustic velocity, and thickness of the epicardium are studied. The scattering cross section of the myocardium is also measured. A phantom which has the acoustic properties of th epicardium is described. A set of design equations is developed and used to predict scanner performance. Imaging systems with adjustable frequency and pulse length provide higher performance in varied anatomical environments than conventional fixed frequency, shock excited systems. A combination of higher frequency and longer pulses increases lateral resolution with little cost in volumetric resolution. The use of signal processing methods to increase system sensitivity was studied. Pulse to pulse coherence measurements indicated that coherent processing could be used during certain parts of the cardiac cycle for images of the liver. Dissert. Abstr.

N80-24125 Brown Univ., Providence, R. I.
A GENERAL THEORY FOR THE SCATTERING OF SOUND BY SOUND WITH PARAMETRIC ARRAY APPLICATIONS Ph.D. Thesis
Harvey Charles Woodsum 1979 62 p
Avail: Univ. Microfilms Order No. 8007077

A general theory of the scattering of sound by sound, which is exact to second order, was derived in terms of plane wave expansions. The solution involves an extension for the second order scattering of two plane acoustic waves to include the effects of viscosity. The plane wave expansions for the sum and difference frequency components of the second order scattered field were obtained in terms of the fundamanetal solution for the scattering of two plane waves, and the plane wave expansion coefficients for the primary fields. Applications to parametric transmitting and receiving arrays are presented, with advantages being noted in that quite general field geometries can be treated with the plane wave expansion technique. Dissert. Abstr.

N80-24127 Catholic Univ. of America, Washington, D. C.
NORMAL MODE ACOUSTIC SCATTERING FROM ELASTIC CYLINDRICAL SHELLS Ph.D. Thesis
Edward Darwin Breitenbach 1980 150 p
Avail: Univ. Microfilms Order No. 8010934

Acoustic scattering from a fluid loaded air backed infinite elastic cylindrical shell was examined using partial wave analysis. The partial wave technique was applied to a thick shell, from which dispersion curves are derived for the identified circumferential Rayleigh transverse, and longitudinal modes. The validity of the partial wave analysis was confirmed. A response enhancement method was developed to isolate the elastic resonances excited by the circumferential modes on thick intermediate and thin shells. Specific mode responses were traced through the transition to a thin shell. Mode responses were examined for the continuous order representation at discrete value of ka. Dissert. Abstr.

N80-24128 Brown Univ., Providence, R. I.
THE INTERACTION OF SOUND WITH NOISE IN WATER Ph.D. Thesis
Timothy Kevin Stanton 1979 126 p
Avail: Univ. Microfilms Order No. 8007070

The nonlinear interaction of a monochromatic ultrasonic signal with audio frequency noise was measured in water. The scattered signal lies in sidebands corresponding to the sum and difference components of the frequencies involved. The intensity of the scattered signal increases linearly with interaction distance and quadratically with the signal frequency in the range 1-4 MHz. An estimation of the scattered intensity was made by characterizing the 2.28 kHz component of the noise field in terms of its complex intensity. In each interaction measurement, a continuous wave signal of amplitude less than 0.2 atm was generated in water by a ceramic transducer. After passage through distances up to 90 cm, the beam was detected by a second transducer and fed to a spectrum analyzer. The noise in the medium was provided by a mechanical noise generator striking the metallic wall of the water-filled tank. The noise spectrum lay between 2.8 kHz, with component amplitudes up to 0.005 atm. A wattmeter is described which is capable of measuring separately the real and imaginary parts of the complex acoustic intensity in water. A general expression for the complex intensity is derived and used to provide a basis for the measurements. Dissert. Abstr.

N80-24129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FAR-FIELD RADIATION OF AFT TURBOFAN NOISE
Edward J. Rice and Arthur V. Saule 1980 25 p refs Presented at 99th Meeting of the Acoust. Soc. of Am., Atlanta, 21-25 Apr. 1980
(NASA-TM-81506; e-444) Avail: NTIS HC A02/MF A01 CSCL 20A

Approximate expressions were developed for the noise radiation from the aft duct. The results of approximate aft radiation equation compare favorably to more exact Wiener-Hopf radiation results. Refraction as well as convective effects in the multiple flow streams is considered. The peak in the radiation pattern, which occurs nearly at engine sideline, is composed of modes with relatively large cut-off ratios. This implies that aft fan radiation will be inherently more difficult to suppress that the fan inlet noise. The theoretical multimodal radiation pattern is compared to experimental data for the first two harmonics of blade passage frequency for three full scale fans at two speeds. The agreement between theory and experiment is quite good. A.R.H.

N80-24130# New Mexico State Univ., Las Cruces. Physical Science Lab.
HYPERBOLIC FITS TO TIME-OF-ARRIVAL SOUND RANGING MEASUREMENTS
Don Hoock and Mike Marotta Dec. 1979 31 p
(Contract DAAD07-79-C-0008; DA Proj. 1L1-62111-AH-71) (AD-A080746; ERADCOM/ASL-CR-79-0008-3) Avail: NTIS HC A03/MF A01 CSCL 17/1

A simple algorithm is presented for fitting a hyperbola to the times of arrival of sounds at each of several microphone locations along a linear array. Timing points, taken in groups of three, are tested for causality to determine that they can be associated with a physically realizable source location. The resulting parameters defining the fit or averaged hyperbola are themselves an initial estimate of source location and sound emission time. After transformation to field coordinates, these estimates are capable of being used as input to existing sound ranging algorithms which correct for wind and temperature. If displayed with raw data, the hyperbola may be used in future to aid personnel in identifying related signals from among background clutter and for initial visual assessment of data quality. The algorithm is expected to be a useful tool in supporting advanced ranging techniques. GRA

N80-24131# Oregon State Univ., Corvallis. School of Oceanography.
BACKSCATTERING PROGRAMS FOR SPHERICAL TARGETS
Richard K. Johnson, Lawrence Flax (NRL, Washington, D. C.), and David Standley Apr. 1979 34 p refs
(Contract N00014-76-C-0067; NR Proj. 038-102) (AD-A081094; REF-79-7) Avail: NTIS HC A03/MF A01 CSCL 20/1

These programs compute the acoustical reflectivity of a sphere in a fluid medium. The programs differ in the allowed physical properties of the spheres. The principal outputs of the programs are plots of reflectivity, R-squared, as a function of size-frequency, ka. The reflectivity is defined as R-squared = (sigma sub b)/(a-squared/4) where sigma sub b is the backscattering cross-section of the sphere, and a-squared/4 is the backscattering cross-section of a completely reflecting sphere of radius a. The variable k is the wavenumber in the medium. These plots may be considered as dimensionless representations of target strength vs. frequency. The conversions are TS = 10 log (R-squared times a-squared/4) and f = cKa/2pia with a in meters, c in meters per second and f in kHz. This relation for frequency is such that the product of frequency in kHz and radius in mm is 240 when ka = 1. These programs have been used primarily for low contrast cases (with g and h near one) at relatively low values of ka (less than 10). GRA

N80-24132# Harry Diamond Labs., Adelphi, Md.
ANALYSIS OF ULTRASONIC FLOWMETERS FOR LEAK DETECTION IN LIQUID HYDROCARBON PIPELINES
Stacy E. Gehman and Allen B. Holmes Dec. 1979 26 p ref (AD-A081791; HDL-TR-1907) Avail: NTIS HC A03/MF CSCL 03/11

A program was conducted to determine repeatability and linearity of the ultrasonic time-delay types of flowmeters, so that their applicability to leak detection on underwater pipelines could be assessed. Field tests using merchantable crude oil were conducted on two off-the-shelf, commercially available flowmeters at a refinery meter proving station. These tests showed a short-term repeatability of 0.2 percent for both meters. Long-term (7 hours) repeatability was 0.6 percent for one meter and 2.5 percent for the other. For a leak detection system in which line balance is continually computed and line packing is compensated for, slow drifts in line balance due to drifts of meter factors can be compensated for by periodically adjusting meter factors. For a meter with drift characteristics similar to those measured, a computerized simulation indicates that the probability of detecting a leak greater than 0.6 of the total flow in 10 minutes is greater than 99 percent. The probability of a false alarm for the same conditions is about once per week. GRA

N80-24133# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF AN EXPERIMENTAL PROBE FOR THE MEASUREMENT OF THE ACOUSTIC PRESSURE INSIDE AN AIRFLOW Thesis - Paris VI Univ.
Herve Huguenin 1979 63 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-633)
(ONERA-NT-1979-5) Avail: NTIS HC A04/MF A01

The turbulence generated by the presence of a microphone, placed to study the origin of noise of an aircraft in motion, and the effect it has upon the measurements of acoustic pressure within the fluids in motion are discussed. An acoustic probe, designed to reduce the influence of the instrument during such measurements is described. The principle of the probe is reported and performance tests on the probe and their results are evaluated. Author (ESA)

N80-24134# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPECTRAL ANALYSIS OF NON-STATIONARY RANDOM PROCESSES. APPLICATION TO NOISE OF FLYOVER TYPE Thesis - Paris-Sud Univ.
Max Ernoult 1979 180 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-639)
(ONERA-NT-1979-4) Avail: NTIS HC A09/MF A01

Nonstationary noise detected by fixed microphones was studied during the passage of a moving acoustic source (e.g., aircraft flyover noise), with the objectives of measuring the noise radiation pattern and characterizing the spatial distribution of the noise. A time frequency representation of the energy of nonstationary random processes and a series of charts which allows the adaptation of the spectral analysis processes to the treatment of nonstationary signals are presented. The characteristics pertaining to the nonstationarity of an aircraft noise determined in the far field, are discussed. Author (ESA)

N80-24248 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
RECENT DEVELOPMENT FOR THE NONLINEAR DISTORTION OF NON-DISPERSIVE ACOUSTIC WAVES. PART 2: MULTIDIMENSIONAL SYSTEMS
J. H. Ginsberg *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 3-12 refs (For primary document see N80-24247 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N80-24135 Stanford Univ., Calif.
MULTIQUANTUM ULTRAVIOLET EXCITATION OF ATOMS AND MOLECULES Ph.D. Thesis
Jeffrey Bokor 1980 174 p
Avail: Univ. Microfilms Order No. 8011810

Properties of a variety of atoms and molecules prepared in high lying electronically excited states were studied by multiphoton absorption of rare gas halide ultraviolet laser radiation. The basic technique used involved the observation of laser induced fluorescence from gaseous samples irradiated by an argon fluoride (193 nm) or krypton fluoride (248 nm) laser. A specially constructed tunable laser source was used in some of the experiments. Following a review of the theory of multiphoton absorption processes, and the fundamental properties of high power ultraviolet lasers, the experimental results are described. Dissert. Abstr.

N80-24136 Texas Univ. at Austin.
MEASUREMENTS OF THE TOTAL ELASTIC SCATTERING CROSS SECTION FOR ARGON ON ARGON AT COLLISION ENERGIES BELOW FOUR MILLIVOLTS Ph.D. Thesis
Georges Edward Jamieson 1979 75 p
Avail: Univ. Microfilms Order No. 8009878

Total elastic scattering cross sections for argon on argon were measured over the energy range of two to four millivolts. Identical particle symmetry oscillations were clearly resolved, with two maxima and three minima observed. Comparisons were made with computed cross sections. Relative positions of the sharp minima were more accurately determined than absolute positions, with the locations of the maxima and the shapes of the peaks being the less accurately measured quantities. Dissert. Abstr.

N80-24137 New York Univ., N. Y.
SCATTERING OF LOW-ENERGY ELECTRONS BY LASER EXCITED SODIUM ATOMS IN THE 3 2P 3/2 STATE Ph.D. Thesis
Richard Kaoyu Dang 1979 124 p
Avail: Univ. Microfilms Order No. 8010334

The atomic beam double-recoil technique was used to measure total cross sections for the scattering of electrons by sodium atoms. The electron energy ranges from 0.85 to 6 eV. A single mode, tunable dye laser is projected into the interaction region to raise some of the atoms from the ground state to a higher state. The fraction of atoms that are in the excited state was determined by observing the net atomic beam recoil due to resonant photon interaction in the direction of the laser beam. The mixture of the ground and the excited state of the sodium atoms was then cross-fired by a modulated electron beam. Dissert. Abstr.

N80-24138# Toronto Univ. (Ontario).
STUDIES OF LASER SELECTIVE EXCITATION OF ATOMS
Norbert Drewell Dec. 1979 151 p refs
(Grant AF-AFOSR-2902-76)
(UTIAS-229; ISSN-0082-5255) Avail: NTIS HC A08/MF A01

Sample preparation through laser ablation of a solid target under vacuum was combined with short-pulsed laser selective excitation to create a technique for measuring atomic radiative lifetimes. The lifetimes of the three resonance states of chromium compare very favorably with those found through other experimental means. The technique was extended to demonstrate the potential for plasma dianostics using two-wavelength selective excitation with short laser pulses. The ratio of population densities of two energy states of chromium atoms was measured as a function of time during the expansion of the ablation plasma. Extended saturation pumping of the resonance transition in sodium vapor was also investigated. Rate equations for 20 energy levels in the sodium atom, and the rate equations for the free electrons ,were integrated numerically. It was found that multiphoton ionization, combined with superelastic heating of free electrons can account for the rapid and complete ionization of an un-ionized vapor. The theoretical results led to the development of a simple model which accurately predicts the temporal variation of electron density. A.R.H.

N80-24139# Texas Univ. at El Paso.
COMPUTERIZED METHOD FOR THE GENERATION OF MOLECULAR TRANSMITTANCE FUNCTIONS IN THE INFRARED REGION Final Report
Joseph H. Pierluissi and Ken Tomiyama 31 Dec. 1979 195 p refs

(Contract DAAG29-79-C-0067)
(AD-A081789; FR1-79-UA-72; ARO-16641.1-GS) Avail: NTIS HC A09/MF A01 CSCL 07/4

A study is made of two basically distinct methods normally used in the development of band models for the calculation of gaseous molecular transmittance in the infrared region. The first method consists of the determination of the 'empirical' transmittance function and the associated absorber and spectral parameters from measured or calculated transmittance spectra. The second method consists of the determination of the absorber and spectral parameters with an assumed 'analytical' transmittance function, using the same type of data. Computerized numerical techniques are presented in connection with the first method and a generalized transmittance function is adopted for the second method. Although the methodology is generally applicable to other gaseous species, it is specifically discussed in connection with the trace gases SO2, NO, NO2, and NH3. As a secondary effort a structural breakdown of the Lowtran code is presented for the purpose of incorporating the band models for the trace gases. GRA

N80-24140# Arizona Univ., Tucson. Optical Sciences Center.
COHERENT TRANSIENT EFFECT STUDIES OF RYDBERG ATOMS Interim Report, 16 Jun. 1979 - 1 Mar. 1980
Richard L. Shoemaker and William H. Wing 27 Feb. 1980 8 p refs
(Contract N00014-79-C-0488; NR Proj. 393-041; RR0110301)
(AD-A081746) Avail: NTIS HC A02/MF A01 CSCL 0"/4

New techniques for making time-resolved studies of atoms in highly excited (Rydberg) states will be developed. In particular, the absorption or emission of radiation by Rydberg-state atoms will be monitored on a nanosecond time scale during and after irradiation by various laser pulse sequences. The signals thus produced (known as coherent transient effects), will be studied in order to provide both information about collisional relaxation processes in Rydberg atoms and other spectroscopic data. GRA

N80-24141# Duke Univ., Durham, N. C. Dept. of Physics.
MICROWAVE INVESTIGATIONS OF MATTER Final Report, 3 Nov. 1973 - 30 Oct. 1976
Walter Gordy 22 Feb. 1980 19 p refs
(Grant DAHC04-74-G-0034)
(AD-A081708; ARO-11803.23-P) Avail: NTIS HC A02/MF A01 CSCL 07/4

This report contains a bibliography of nineteen published papers. These results fall into two broad classifications: (a) Millimeter and Submillimeter Wave Studies; and (b) Solid State Studies with ESR and ENDOR. GRA

N80-24142# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
CROSSED BEAM REACTIVE SCATTERING OF OXYGEN ATOMS AND SURFACE SCATTERING STUDIES OF GASEOUS CONDENSATION Ph.D. Thesis
Steven Jay Sibener Sep. 1979 243 p refs
(Contract W-7405-eng-48)
(LBL-9811) Avail: NTIS HC A11/MF A01

A high pressure, radio frequency discharge nozzle beam source was developed for the production of very intense supersonic beams of oxygen atoms. This source is capable of producing seeded beams of ground state atoms when dilute oxygen-argon mixtures are used, with molecular dissociation levels exceeding 80% being realized for operation at pressures up to 350 torr. When dilute oxygen-helium mixtures are employed, both ground state and excited state atoms are present in the terminal beam, with molecular dissociation levels typically exceeding 60% being achieved for operation at pressures up to 200 torr. Atomic oxygen mean translational energies from 0.14 to 0.50 eV were obtained using the seeded beams technique, with Mach numbers as high as 10 (FWHM delta v/v approximately 20%) being realized. The ICl, CF3I, C6H6, and C6D6 reactions are discussed. A series of beam-surface scattering experiments is also described which examined the internal and translational energy dependence of molecular condensation probabilities for collisions involving either CCl4 or SF6 and their respective condensed phases. DOE

N80-24143# Wright State Univ., Dayton, Ohio. Dept. of Chemistry.
ABSORPTION OF H AND D LYMAN-ALPHA RADIATION BY O2 MOLECULES AT HIGH TEMPERATURES
C. C. Chiang and Gordon B. Skinner 1979 12 p refs
(Contract EY-76-S-02-2944)
(COO-2944-T2) Avail: NTIS HC A02/MF A01

Absorption cross sections of molecular oxygen were measured at the H and D Lyman alpha wavelengths (1215.67 and 1215.34A) between 800 and 1700 K. Vibrational relaxation times were in agreement with literature data over the range of common temperatures. DOE

N80-24144# California Univ., Berkeley. Lawrence Berkeley Lab.
NEGATIVE-HYDROGEN-ION PRODUCTION BY BACKSCATTERING FROM ALKALI-METAL TARGETS
P. J. Schneider, K. H. Berkner, W. G. Graham, R. V. Pyle, and J. W. Stearns Nov. 1979 12 p refs Presented at the Workshop on Hydrogen Recycling, Dublin, Calif., 17-18 Oct. 1979
(Contract W-7405-eng-48)
(LBL-9992; CONF-791057-2) Avail: NTIS HC A02/MF A01

Measurements were made of the total backscattering D(-) and H(-) yields from Cs, Rb, K, Na, and Li surfaces bombarded with D2(+), D3(+), H2(+), andH3(+) in the energy range 0.15 to 4 keV/nucleus. All measurements were made at a background pressure less than 10 to the minus 9th power Torr and the alkali metal surfaces were evaporated onto a substrate in situ to minimize contamination of surfaces. Measurements of the H(-) yield were also made for H(+) bombarding a W substrate, as a function of the work function of the target, as Li was deposited on the W. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N80-24145# California State Univ., Los Angeles. Plasma Physics Group.
COLLECTIVE DRAG EXPERIENCED BY AN ELECTRON BEAM IN THE PURE RUNAWAY REGIME
G. J. Morales Oct. 1979 10 p refs
(Contract N00014-75-C-0476)
(AD-A081116; PPG-436) Avail: NTIS HC A02/MF A01 CSCL 20/9

A calculation is presented of the drag experienced by a continuously accelerated cold electron beam due to the swept excitation of the finite bandwidth two-stream instability. GRA

N80-24146# Canadian Industries Ltd., Kingston (Ontario). Environmental Improvement Business Area.
SWARU: SOLID WASTE DISPOSAL RESOURCE SYSTEM
[1979] 13 p
(NP-24196) Avail: NTIS HC A02/MF A01

The SWARU solid waste disposal resource recovery process a comprehensive system which can accept garbage and wastes of all kinds and converts the constituents to their highest and best economic use, is described. The incineration and materials handling technology, which facilitates resource recovery and ensures high thermal efficiency is evaluated and emissions from the plant are analyzed. DOE

N80-24147# Texas Univ., Austin. Center for Particle Theory.
SYNTHESIS OF BARYONS FROM UNCONFINED QUARKS
D. Dicus, J. Pati, and V. Teplitz Sep. 1979 21 p refs Prepared in cooperation with Maryland Univ., College Park and Arms Control and Disarmament Agency, Washington, D.C.
(Contract EY-76-S-05-3992)
(ORO-3992-371) Avail: NTI HC A02/MF A01

The cosmic temperature at which primordial quarks condense into baryons is calculated for a number of cases within a field theory of partially confined quarks that enjoys temporary

asymptotic freedom. It is assumed that the mass of a quark in a dense quark antiquark medium is a monotonic function of the medium, that is, that the so-called Archimedes effect is valid. It is shown that, within such models, unbound quark lifetimes are larger than the age of the universe at the time of the transition and that the Archimedes effect implies that the change of the medium from free to bound quarks is a phase transition. DOE

N80-24148# Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands).
RADIATION AND SHIELDING AROUND BEAM ABSORBERS
A. Hurkmans and R. Maas Dec. 1978 48 p refs
(INTERIKO-78/7) Avail: NTIS HC A03/MF A01

Radiation levels found in the vicinity of particle accelerators are reviewed. Shielding requirements, radiation under no beam conditions and under operational conditions (gamma, low energy and high energy neutrons), and contributions from various metal components (i.e., copper collimeters) are shown. Tables of radiation susceptibility for selected materials and electronic equipment are provided, as well as some relations concerning dose rates.
Author (ESA)

74 OPTICS

Includes light phenomena.

N80-24149* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD OF FORMING A SHARP EDGE ON AN OPTICAL DEVICE Patent
Charles M. Fleetwood and Stephen H. Rice Issued 22 Apr. 1980 8 p Filed 28 Jul. 1978 Supersedes N78-29902 (16 - 23, p 2729)
(NASA-Case-GSC-12348-1; US-Patent-4,198,788; US-Patent-Appl-SN-929088; US-Patent-Class-51-283R; US-Patent-Class-51-277; US-Patent-Class-65-61) Avail: US Patent and Trademark Office CSCL 20F

A sharp edge is formed on an optical device by placing the optical device in a holding mechanism; grinding one surface so that it and a surface of the holding mechanism are co-planar; and polishing both the surface of the optical device and the surface of the holding mechanism with felt until an edge on the surface of the optical device adjacent to the surface of the holding mechanism obtains a desired sharpness.
Official Gazette of the U.S. Patent and Trademark Office

N80-24150 Stanford Univ., Calif.
HIGH RESOLUTION OPTICAL RANGING SYSTEM Ph.D. Thesis
Heungsup Park 1980 108 p
Avail: Univ. Microfilms Order No. 8011690

Reflection from a viewed object can be detected with a high signal to noise ratio, by sending short pulses into a scattering and absorbing medium, and opening an optical gate only during the time when the light reflected from a specified range returns. By using picosecond pulses and a picosecond optical gate 0.3 mm spatial resolution can be achieved. A pulsed (picosecond) local oscillator for heterodyne detection of the reflected picosecond pulses constitutes the fast optical gate. The pulses from a mode locked dye laser at some optical frequency are incident upon an acoustic wave to provide a frequency shifted wave, by Bragg diffraction. The reference signal at the shifted frequency passes through a variable delay element and goes to the photocathode of a photomultiplier. The direct beam at the original frequency, in passing through an absorbing and scattering medium, is reflected and backscattered continuously. The reflected signal is consequently dispersed in time. Dissert. Abstr.

N80-24151*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GLADSTONE-DALE CONSTANT FOR CF4
Alpheus W. Burner, Jr. and William K. Goad May 1980 18 p refs
(NASA-TM-80228; L-13551) Avail: NTIS HC A02/MF A01 CSCL 20F

The Gladstone-Dale constant, which relates the refractive index to density, was measured for CF4 by counting fringes of a two-beam interferometer, one beam of which passes through a cell containing the test gas. The experimental approach and sources of systematic and imprecision errors are discussed. The constant for CF4 was measured at several wavelengths in the visible region of the spectrum. A value of 0.122 cu cm/g with an uncertainty of plus or minus 0.001 cu cm/g was determined for use in the visible region. A procedure for noting the departure of the gas density from the ideal-gas law is discussed. A.R.H.

N80-24152*# National Aeronautics and Space Administration. Pasadena Office, Calif.
CONSTANT MAGNIFICATION OPTICAL TRACKING SYSTEM Patent Application
Robert E. Frazer, inventor (to NASA) (JPL) Filed 30 Apr. 1980 14 p
(Contract NAS7-100)
(NASA-Case-NPO-14813-1; US-Patent-Appl-SN-145282) Avail: NTIS HC A02/MF A01 CSCL 20F

A constant magnification optical tracking system is disclosed wherein a traveling objective lens maintains a fixed relationship to an object to be optically tracked. The objective lens is chosen to provide a collimated light beam oriented in the direction of travel of the moving object. A reflective surface is attached to the traveling objective lens for reflecting an image of the moving object to the lens. The moving object is maintained at the focal point of the traveling objective lens. A motor and control means is provided for maintaining the traveling objective lens in a fixed relationship relative to a free falling object, thereby keeping said object at the focal point and centered on the axis of the traveling objective lens throughout its entire free fall path. NASA

N80-24153# Harry Diamond Labs., Adelphi, Md.
THE OPTICAL PROCESSOR AS AN ARRAY ANTENNA CONTROLLER
James S. Shreve Nov. 1979 40 p ref
(DA Proj. 1L4-63737-D-181)
(AD-A081790; HDL-TR-1905) Avail: NTIS HC A03/MF A01 CSCL 20/6

Presented here are the results of an investigation into the feasibility of employing a coherent optical processor as a real time computer for controlling a phased-array antenna. Specifically, the role of the processor was to determine the appropriate phase and amplitude distributions across the array antenna aperture. The desired antenna control included the dynamic control of antenna beam shape and position, the independent control of simultaneous multiple beams, and the independent control of antenna-pattern nulls. GRA

N80-24154# EMTEC Engineering, Inc., Los Angeles, Calif.
ANALYSIS OF MULTIMODE FIBER COUPLERS, TAPERS AND MODE CONVERTERS Final Technical Report, 4 Aug. 1978 - 31 Jul. 1979
C. Yeh Griffiss AFB, N.Y. RADC Jan. 1980 115 p refs
(Contract F19628-78-C-0206; AF Proj. 2306)
(AD-A081669; EM-F-01; RADC-TR-79-341) Avail: NTIS HC A06/MF A01 CSCL 20/6

This is a final report on the analysis of multimode fiber couplers, tapers and mode converters. A method based on the fast Fourier transform technique of scalar wave equation has been successfully developed to yield numerical results on a number of practical multimode fiber components. Included in this report are listings of the computer programs. GRA

N80-24155# Owens-Illinois, Inc., Toledo, Ohio.
EVALUATION OF NRL GLASS FOR FIBER OPTICS, PHASE 1 Interim Report, Oct. 1978 - 15 Jun. 1979
14 Sep. 1979 36 p refs
(Contract N00173-78-C-0242)
(AD-A081582) Avail: NTIS HC A03/MF A01 CSCL 11/2

This interim report covers a Phase 1 activity to develop glasses for medium loss fiber optic waveguides. The requirements of the final fiber are that it should have: (1) a diameter of 75 to 125 micrometers with a 50 to 75 micrometers core; (2) a numerical aperture of 0.4 to 0.6; (3) losses of approximately 100 dB/km; and (4) radiation resistance. The Phase 1 activities included the evaluation of a special NRL core glass composition, development of several promising clad glasses and fabricating

a test fiber utilizing one of the clad glasses over the NRL core. Meeting the loss requirement was not an objective in Phase 1. GRA

N80-24156# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
FIELD MANUAL TO DETERMINE DETECTION OR RECOGNITION RANGE OF A FLIR SENSOR Final Report
Lynne N. Seekamp Sep. 1979 32 p refs
(Contract MDA903-79-C-0202)
(AD-A081324; AD-E500112; IDA-P-1419; IDA/HQ-79-21390) Avail: NTIS HC A03/MF A01 CSCL 17/5

Forward-looking infrared (FLIR) sensor performance range estimates over a horizontal path can be made by using a rapid estimation procedure. These estimates can be calculated while in the field by using a hand calculator for several different FLIR systems, atmospheric transmission conditions, and levels of difficulty of the visual task. GRA

N80-24157# Arizona Univ., Tucson. Optical Sciences Center.
OPTIMUM OPTICAL STRUCTURES FOR ACTIVE CONTROL Final Report
R. R. Shannon, R. M. Richard, and J. G. R. Hansen 21 Jan. 1980 67 p refs Sponsored in part by DARPA
(Contract N00014-78-C-0282)
(AD-A080934) Avail: NTIS HC A04/MF A01 CSCL 20/6

A NASTRAN structural analysis of a lightweight mirror structure has been completed and is compared with previous experimental measurements. A preliminary design for a 4 meter aperture, 6 meter focal length primary mirror is presented. GRA

N80-24158# Naval Postgraduate School, Monterey, Calif.
EFFICIENT ADAPTIVE FIR AND IIR FILTERS Ph.D. Thesis
Uzi Ben-Yakov Dec. 1979 149 p refs
(AD-A081605) Avail: NTIS HC A07/MF A01 CSCL 17/5

Self adaptive filters adjust their parameters to perform an almost optimal filtering operation without a prior knowledge of the input signal statistics. Two approaches to the design of efficient self adaptive discrete filtering algorithms are considered. For non-recursive (FIR) adaptive filters, simplified estimations of the gradient of the performance function to be minimized are considered. These algorithms result in reduced complexity of implementation, improved dynamic operating range with about the same misadjustment errors and convergence time as the classic LMS (Least Means Squared) algorithm. An analysis of the simplified gradient approach is presented and confirmed experimentally for the specific example of an adaptive line enhancer (ALE). The results are used to compare the simplified gradient approaches with each other and the LMS algorithm. This comparison is done using a new graphic presentation of adaptive filter operating characteristics and a complexity index. This comparison indicates that the simplified gradient estimators are superior to the LMS algorithm for filters of equal complexity. GRA

N80-24159# Naval Research Lab., Washington, D. C. Electro-Optical Technology Program Office.
PASSIVE INFRARED SURVEILLANCE. PART 2: THRESHOLD-CROSSING RECEIVERS Interim Report
Richard A. Steinberg 24 Jan. 1980 61 p refs
(ZF32391003)
(AD-A081723; AD-E000373; NRL-8367; EOTPO-57) Avail: NTIS HC A04/MF A01 CSCL 17/5

A number of infrared passive surveillance receivers are analyzed with the theory developed in Part 1 (NRL Report 8320). The specific problem of interest is the detection of low-contrast point-source targets against high-contrast structured backgrounds. A new and promising approach to signal processing is proposed for minimizing background-induced false alarms while retaining maximum target-detection sensitivity. It is shown that improvements in focal-plane-array (FPA) technology employing time delay and integration (TDI) may afford 'excess' detector sensitivity that can be intentionally sacrificed in the interest of enhanced performance against structured scenes. GRA

N80-24160# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Hauptabteilung Vorprojekte und Studien.
ANALYSIS OF SPECIAL COMPONENTS OF THE EUV-VERY WIDE ANGLE CAMERA Final Report
Rainer Krieger, Irmin Meyer, Fritz Fischer, Heinz Stolze, and Peter Vits Bonn Bundesmin. fuer Forsch. und Technol. Jul. 1979 118 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol. Prepared in cooperation with Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg, West Germany
(BMFT-FB-W-79-04) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldschafen, West Germany DM 24,35

The development of special components for a wide angle camera is described. The description included are: the design principles of the detector transportation mechanism; the measurement of the optical constants of LiF; the measurement of the reflectivity of mirror surfaces; and the layout of a LiF Schmidt plate. Author (ESA)

N80-24161# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Dynamik der Flugsysteme.
MODEL OF A STARFIELD IDENTIFIER Final Report
Lothar Schmieder and Siegbert Graf vomHagen (Kyberna G.m.b.H.) Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 126 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-W-79-05) Avail: NTIS HC A07/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 26,05

An optical scanning device with the capability of identifying the brightest stars in its field of view is discussed. Highly sensitive single diodes with a field of view of 2 deg are used allowing a positional accuracy for the entire device of 2 min. Data on 1400 stars were collected and stored on magnetic tape, for simulating and testing. Author (ESA)

N80-24162# Physics Lab. RVO-TNO, The Hague (Netherlands).
THE BEHAVIOR OF OPTICAL GLASS FIBERS AT EXTREME TEMPERATURES
G. J. Kunz Oct. 1978 25 p refs In DUTCH; ENGLISH summary
(PHL-1978-37; TDCX-71759) Avail: NTIS HC A02/MF A01

Several parameters of glass fibers were determined at temperatures between -60 and +80 C, for fibers 50 m long. The problem of fiber end preparation is discussed. Pulse dispersion at .5 ns was measured. Author (ESA)

N80-24163# Zeiss (Carl), Oberkochen (West Germany).
DEVELOPMENT OF NEW TECHNOLOGIES FOR ULTRA-PRECISE LARGE-SCALE ASTRONOMICAL INSTRUMENTS, IN PARTICULAR MIRROR TELESCOPES Final Report
Christophe Kuehne Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 53 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-10) Avail: NTIS HC A04/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 10,30

The development of an industrial production facility for the manufacturing of mirror telescopes in sizes of up to 4 m in diameter is described. The production facility was tested by making a psuedo mirror of granite ground stock and cement. The development of a mirror mount is described, together with the drive, the associated electronics, and the computer. Author (ESA)

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N80-24164 Colorado Univ. at Boulder.
EFFECTS OF IMPURITY RADIATION ON REVERSED-FIELD PINCH EVOLUTION Ph.D. Thesis
Edward James Caramana 1979 145 p
Avail: Univ. Microfilms Order No. 8011266

A one dimensional MHD simulation code that includes both plasma transport and impurity effects and follows the plasma through a series of equilibrium states was used. The equations are split into two sets, one that contains plasma transport and another that contains atomic physics effects. Two codes were developed and linked together to solve the full problem. Results are presented for the ZT-S, ZT-40, and RFX experiments with a fixed set of parameters, typical or envisioned, and various concentrations of impurities. Radiation barriers are encountered and limits are found on the acceptable level of low Z impurities that may be present in these devices. A criterion for radiation barrier burn-through is derived in terms of appropriate nondimensional parameters and calibrated by comparison to the numerical simulations for the case of oxygen. Thermal instability in the reversed-field pinch is explored. For the case of a reversed-field pinch in a nearly force-free equilibrium, after the formation phase, as the plasma attempts to ohmically heat to a significant beta. Dissert. Abstr.

N80-24165# California Univ., Livermore. Lawrence Livermore Lab.

ELIMINATION OF DEFECTS IN PLASMA POLYMERIZED FILMS USED IN LASER FUSION TARGETS

S. A. Letts, W. L. Johnson, D. W. Myers, J. D. Illige, L. E. Lorenson, and C. W. Hatcher 11 Apr. 1979 10 p refs

(Contract W-7405-eng-48)

(UCID-18324) Avail: NTIS HC A02/MF A01

The identification and control of the parameters which govern the formation of defects in plasma polymerized surfaces are discussed. The process variables (power dissipated in the discharge, pressure and rate of monomer flow) which control the nature of the plasma were studied using an inductively coupled discharge. Preexisting irregularities on the polymerized surfaces were examined using flourocarbon coated glass slides. The relationship between the size of a substrate irregularity and the defect it generates is discussed and the effect of the substrate irregularities upon the coating smoothness is described. A.R.H.

N80-24166# Arizona Univ., Tucson. Dept. Of Chemistry.

A HIGH POWER INDUCTIVELY COUPLED PLASMA TORCH AND IMPEDANCE MATCHING NETWORK Interim Report

D. L. Windsor, D. R. Heine, and M. B. Denton 13 Apr. 1979 15 p refs

(Contract N00014-75-C-0513; NR Proj. 051-549)

(AD-A080906; TR-22) Avail: NTIS HC A02/MF A01 CSCL 20/9

The relative ease of operation, power handling capabilities and overall performance of an inductively coupled- plasma-optical emission spectrometer (ICP-OES) depends upon numerous factors, not the least important of which is the design of the torch. A variety of such designs has appeared in the literature. Most workers have employed three concentric fused silica and/or pyrex tubes, referred to as an inner sample gas tube, a 'flaired mouth' plasma gas tube, and an outer coolant tube. These tubes are either fused into one or two-piece units through glass blowing techniques or mounted in some type of dismantleable base assembly. Precise alignment of the glass-blown torch can be achieved during construction through the use of an assembly jig. However, this type of torch is not easily repaired should problems be encountered. The dismantleable base approach can be difficult to align if the three tubes are held only near the bottom. This problem is aggravated by the fact that rarely is commercial quartz and pyrex glass tubing perfectly straight or cylindrical. A torch design which is both dismantleable and self-aligning has been successfully used in this laboratory for several years. A unique feature is the use of nylon or teflon slip fit spacers between the sample and plasma gas tubes and the plasma and coolant gas tubes. GRA

N80-24167# California State Univ., Los Angeles. Center for Plasma Physics and Fusing Engineering.

PLASMA BOUNDARY COLLISIONLESS ABSORPTION EFFECTS IN THE LOADING OF RF CONDUCTORS

G. J. Morales Oct. 1979 28 p refs

(Contract N00014-75-C-0476)

(AD-A081115; PPG-435) Avail: NTIS HC A03/MF A01 CSCL 20/9

This study considers the role of collisionless absorption at the boundary between an unmagnetized plasma and a conductor to which an RF potential is applied. The Landau half-space problem is examined from the energetic viewpoint to calculate the surface power absorption due to longitudinal fields. The transverse field absorption is evaluated and the connection with the anomalous skin effect is indicated. The corresponding loading resistance is found to be significant for typical surface plasma parameters. A numerical study of pure bounce absorption heating demonstrates the physical reality of the process and uncovers the existence of a time asymptotic equilibrium between the kinetic energy of the plasma and the externally applied RF potential, independent of initial conditions or parameters. GRA

N80-24168# California Univ., Berkeley. Electronics Research Lab.

ERGODIC ORBITS IN PARTICLE SIMULATIONS OF STRONG ION RINGS

Alex Friedman 28 Jun. 1979 43 p refs

(Contract DE-AS03-76SF-00034)

(AD-A081391; UCB/ERL-M79/41) Avail: NTIS HC A03/MF A01 CSCL 20/9

The existence of ergodic orbits in magnetostatic simulations of strong ion rings is demonstrated. For nonlinear 2 D3 V simulations with axisymmetry the principal manifestation of such orbits is an eventual violation of left-right mirror symmetry in cases where such symmetry would normally be expected, due to the exponential divergence of neighboring, mirror image trajectories. Linearized simulations, in effect, compute the first order separation of orbits which are displaced from each other by an infinitesimal vector for all time. When a linearized code is applied to a problem involving ergodic orbits, the single-particle growth can be faster than that associated with the collective modes of interest, rendering the simulation invalid. This may severely limit the class of problems for which linearized simulation is applicable. Similar effects are expected in simulations of other systems, including field-reversed mirror equilibria with large nominal gyroradii. GRA

N80-24169# Naval Research Lab., Washington, D. C. Experimental Plasma Physics Branch.

TRANSIENT FIELD REVERSAL WITH A PROTON LAYER

C. A. Kapetanakos, J. Golden, J. A. Pasour, S. J. Marsh (Sachs-Freeman Associates, Inc., Bladensburg, Md.), and R. A. Mahaffey (Sachs-Freeman Associates, Inc., Bladensburg, Md.) 27 Dec. 1979 38 p refs

(RR0110941)

(AD-A081724; AD-E000371; NRL-MR-4135) Avail: NTIS HC A03/MF A01 CSCL 20/9

This report describes a series of experiments that led to the transient field reversal of the applied magnetic field with a proton pulse. The 400-500 KA, 50 nsec duration, 1.7 MeV peak energy hollow proton pulse is generated by an Inverse Reflex Tetrode. After passing through the cusp, the pulse propagates in a uniform field with 1.15 cm/nsec axial velocity, when the applied voltage on the anode is 1MV. GRA

N80-24170# Illinois Univ., Urbana. Dept. of Electrical Engineering.

FABRICATION AND CHARACTERIZATION OF CRYOGENIC TARGETS FOR INERTIAL CONFINEMENT FUSION

H. Rieger and Kyekyoon Kim Aug. 1979 63 p refs Prepared for California Univ., Lawrence Livermore Lab.

(Contract W-7405-eng-48)

(UCRL-15113) Avail: NTIS HC A04/MF A01

A technique was developed which is capable of fabricating uniform cryogenic targets for use in inertial confinement fusion. The essence of the technique is to directly wet a target with a cold helium gas jet, which results in freezing of the DT mixture contained in the target. A controlled amount of current is pulsed through a heater wire surrounding the target, giving rise to fast evaporation and refreezing of the DT condensate into a uniform layer. Experiments, which were performed with D2 filled glass microshells are described. A set of data illustrating the technique is presented and analyzed. DOE

N80-24171# Los Alamos Scientific Lab., N. Mex.

CECAM WORKSHOP ON TRANSPORT OF FAST ELECTRONS IN LASER FUSION PLASMAS Progress Report

R. J. Mason 1979 6 p refs Conf. held at Orsay, France, 20 Aug. - 14 Sep. 1979
(Contract W-7405-eng-36)
(LA-UR-79-3308) Avail: NTIS HC A02/MF A01

Three problem areas in laser driven electron transport are discussed. They include: ion-acoustic turbulence as a source of inhibition; the effects of anti E times and anti j heating of the thermals; and the possibility of thermal inhibition by thermal electron runaway or trapping. DOE

N80-24172# Los Alamos Scientific Lab., N. Mex.
NUMERICAL TREATMENT OF LINEARIZED EQUATIONS DESCRIBING INHOMOGENEOUS COLLISIONLESS PLASMAS
H. R. Lewis 1979 11 p refs Presented at the 4th IRIA Intern. Symp. on Computing Methods in Appl. Sci. and Eng., Versailles, France, 10 Dec. 1979
(Contract W-7405-eng-36)
(LA-UR-79-2755; CONF-791201-2) Avail: NTIS HC A02/MF A01

The equations governing the small signal response of spatially inhomogeneous collisionless plasmas were examined and their significance in controlled thermonuclear fusion research is discussed. The development of methods to solve the equation, which are applicable when the equilibrium involves only one nonignorable coordinate is highlighted. DOE

N80-24173# Oak Ridge National Lab., Tenn. Solid State Div.
REMARKS ON THE USE OF DEPOSITION PROBES FOR ANALYSIS OF TOKAMAK BOUNDARY-LAYER PLASMAS
H. Vernickel (Max-Planck-Institut fur Plasmaphysik, Munich, West Germany) Oct. 1979 30 p refs
(Contract W-7405-eng-26)
(ORNL/TM-7034) Avail: NTIS HC A03/MF A01

The deposition of impurities and plasma ions on probes exposed in plasma devices, is discussed as a diagnostic method for characterizing boundary layer plasmas. Quantitative measurements of impurity and plasma particle profiles obtained from ion scattering and nuclear reaction analysis of samples exposed in the plasma edge are described. An analytic model of the boundary layer plasma is utilized to explore the relationship between the deposition profile on such probes and the particle confinement time and ionization probability of wall originated impurities in the boundary layer. DOE

N80-24174# Wisconsin Univ. - Madison. Plasma Physics Lab.
EXPERIMENTAL OBSERVATION OF PLASMA PARAMAGNETISM IN A TOKAMAK
D. J. Holly, S. C. Prager, M. W. Phillips, and J. C. Sprott Sep. 1979 11 p refs
(Contract EY-76-S-02-2387)
(COO-2387-115) Avail: NTIS HC A02/MF A01

The increase in the toroidal magnetic field of a Tokamak due to plasma presence was measured. The measurements are discussed and compared with predictions of an equilibrium code. DOE

N80-24175# Wisconsin Univ. - Madison. Plasma Physics Lab.
AXISYMMETRIC INSTABILITY IN A NONCIRCULAR TOKAMAK: EXPERIMENT AND THEORY
B. Lipschultz, S. C. Prager, A. M. M. Todd (Princeton Plasma Physics Lab., N.J.), and J. Delucia (Princeton Plasma Physics Lab., N.J.) Sep. 1979 49 p refs Submitted for publication
(Contract EY-76-S-02-2387)
(COO-2387-116) Avail: NTIS HC A03/MF A01

The stability of dee, inverse dee, and square cross section plasmas to axisymmetric modes was investigated in Tokapole 2, a tokamak with a four null poloidal divertor. The results are compared with predictions of two numerical stability codes: the PEST code (ideal MHD, linear stability) adapted to tokapole geometry, and a code which follows the nonlinear evolution of shapes similar to tokapole equilibria. DOE

N80-24176# Cornell Univ., Ithaca, N. Y. Lab. of Plasma Studies.
INTENSE ION BEAM APPLICATIONS TO MAGNETIC CONFINEMENT FUSION
R. N. Sudan 24 Sep. 1979 62 p refs
(Contract EG-77-S-02-4460)
(COO-4460-2) Avail: NTIS HC A04/MF A01

The ion ring experiment is described in relation to its trapping effectiveness and continued research proposed is discussed. The long-pulse experimental program is also considered. DOE

N80-24177# California Univ., Livermore. Lawrence Livermore Lab.
VELOCITY DISTRIBUTION IN A PINCHED BEAM
E. P. Lee 17 Sep. 1979 21 p refs
(Contract W-7405-eng-48; ARPA Order 3718)
(UCID-18303) Avail: NTIS HC A02/MF A01

A procedure for distributing transverse velocities to simulate a self pinched beam of specified density profile is described. Examples of the procedures are presented using the flat top, Bennett, and Gaussian Profiles. DOE

N80-24178# California Univ., Berkeley. Lawrence Berkeley Lab. Accelerator and Fusion Research Div.
STUDY OF THE GENERAL PLASMA CHARACTERISTICS OF A HIGH POWER MULTIFILAMENT ION SOURCE Ph.D. Thesis
K. F. Schoenberg Sep. 1979 139 p refs
(Contract W-7405-eng-48)
(LBL-8940) Avail: NTIS HC A07/MF A01

The steady state and time dependent plasma properties which characterize a high power multifilament ion source are discussed. Steady state measurements, obtained via a pulsed electrostatic probe data acquisition system, are described. Fluctuation measurements, obtained via a broadband digital spectral analysis system, are reported. DOE

N80-24179# General Dynamics/Convair, San Diego, Calif.
STRUCTURAL ANALYSIS OF THE MAGNET SYSTEM FOR MIRROR FUSION TEST FACILITY (MFTF), ADDENDUM 1
K. R. Loss and J. W. Wohlwend Sep. 1979 31 p refs
(Contract W-7405-eng-48)
(UCRL-15112; CASD-LLL-78-003) Avail: NTIS HC A03/MF A01

The stress analysis refinement of the MFTF magnet system using GDSAP (general dynamics structural analysis program) and NASTRAN finite element computer models is described. The calculation of a more refined case and jacket stress distribution was the focus of the study. The GDSAP model was refined in the minor radius area to yield a more detailed prediction of the stress distributions in critical areas identified by the previous analysis. Modifications in the case plate thickness and in the conductor pack load distribution and stiffness were included. The GDSAP model was converted to an identical NASTRAN model to determine the influence on stress results using higher order elements. DOE

N80-24180# Science Applications, Inc., La Jolla, Calif. Applied Plasma Studies Lab.
ANTIC: A CODE FOR CALCULATION OF NEUTRAL TRANSPORT IN CYLINDRICAL PLASMAS
S. Tamor Dec. 1979 40 p refs
(Contracts EY-76-C-03-1018; DE-AC03-79ET-53057)
(SAI-79-1056-LJ; LAPS-50) Avail: NTIS HC A03/MF A01

A scheme for computing the steady state transport of neutral atoms in cylindrical plasmas is described. The physical model used represents atoms emerging from charge exchange collisions by an isotropic source of neutrals with energy equal to 3/2 times the local ion temperature. The processes of charge exchange and impact ionization by electrons andions are included. The transport can be described by an integral equation for the charge exchange collision density, and this equation approximated by a set of algebraic equations for the zone average collision densities. A derivation of the appropriate kernel and a technique for computing it are presented. Comparisonof computed results with predictions of other, more exact, codes exhibit quite satisfactory agreement for temperatures as high as 10 keV. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers*.

N80-24181 State Univ. of New York at Stony Brook.
LASER ANNEALING: SURFACE EPITAXIAL CRYSTALLIZATION, SPATIAL VARIATIONS MEASUREMENT, DYNAMICS OF ANNEALING AND OTHER APPLICATIONS Ph.D. Thesis
Lakkur Parthasarathy 1979 152 p
Avail: Univ. Microfilms Order No. 8011077

Annealing and recrystalization of implanted or amorphous layers of semiconductor material through the rapid heating produced by the absorption of laser light is considered. An electrical circuit equivalent to the physical model is described to simulate the laser annealing process. The nonlinear heat equation is numerically solved to give the time evolution of temperature and melting as a function of pulse energy and its duration. The structure, temperature, and frequency dependence of the absorption coefficient and thermal conductivities are taken into consideration. Phase changes involved are explicitly considered. The model is used for explaining recrystalization as well as depths and thresholds for annealing. The results are in good agreement with the experimental data. The model can be used to account for processes that occur both below and after melting, enables the study of special annealing techniques like frequency mixing, pulsing the beam, and assess the spatial variations in annealing. Dissert. Abstr.

N80-24182 Iowa State Univ. of Science and Technology, Ames.
THE EFFECTS OF HYDROGEN CONTENT ON REACTIVELY SPUTTERED AMORPHOUS SILICON FILMS Ph.D. Thesis
Jeffrey Frank Rumer 1979 94 p
Avail: Univ. Microfilms Order No. 8010235

A set of parameters were determined for r.f. reactive sputtering which allow simultaneous control of monohydride and dihydride bond densities in hydrogenated amorphous Si. It is proposed that the predominant effect of dihydride bonds is to reduce the carrier mobility in a-Si while the dominant effect of monohydride bonds is a reduction in the carrier recombination rate. Dissert. Abstr.

N80-24183 Brown Univ., Providence, R. I.
ELECTRONIC STRUCTURE OF SEMICONDUCTING SURFACE INVERSION LAYERS Ph.D. Thesis
Sankar DasSarma 1979 98 p
Avail: Univ. Microfilms Order No. 8006990

The electronic subband structure of semiconducting surface inversion layers is studied using the Green's function approach and many body perturbation theory. Hartree variational functions are used as the basis states in the theory. At finite temperature self energies and quasi-particle energies of low lying subbands are calculated for various inversion layer concentrations. A finite temperature plasmon-pole approximation is employed to evaluate the self-energies in the first order screened interaction. At low concentrations, the magnitudes of self-energies are found to decrease with temperature for all the subbands. However, at high concentrations, the magnitudes of self-energies of the excited subbands increase with temperature, while that of the ground subband continues to decrease. The subband separations including exchange-correlation effects are found to be much less temperature dependent than the Hartree values. Results are also presented for the effect of a uniaxial stress on the self-energies, quasi-particle energies, energy separations and occupancies in different subbands. Dissert. Abstr.

N80-24184 Wayne State Univ., Detroit, Mich.
DYNAMIC PROPERTIES OF VORTICES IN JOSEPHSON TUNNEL JUNCTIONS Ph.D. Thesis
T. V. Rajeevakumar 1979 86 p
Avail: Univ. Microfilms Order No. 8010165

By means of electron tunneling techniques, some of the dynamic properties of vortices in Josephson tunnel junctions were investigated. In particular, two types of vortex motion were studied. The first one involves the nonresonant propagation of isolated vortices and antivortices with reflection from the junction edges. The second type of vortex motion is the simple flux flow which appears as a single ohmic branch in the I-V characteristic. Dissert. Abstr.

N80-24185*# Massachusetts Inst. of Tech., Cambridge. Dept. of Materials Science and Technology.
CRYSTAL GROWTH OF DEVICE QUALITY GaAs IN SPACE Annual Report, 1 Apr. 1979 - 31 Mar. 1980
Harry C. Gatos and Jacek Lagowski May 1980 136 p refs
(Grant NsG-7331)
(NASA-CR-153190) Avail: NTIS HC A07/MF A01 CSCL 20L

The apparatus and techniques used in effort to determine the relationships between crystal growth and electronic properties are described with emphasis on electroepitaxy and melt-grown gallium aresenide crystal. Applications of deep level transient spectroscopy, derivative photocapitance spectroscopy, and SEM-cathodoluminescene in characterizing wide bandgap semiconductors; determining photoionization in MOS, Schottky barriers, and p-n junctions; and for identifying inhomogeneities are examined, as well as the compensation of indium phosphide. A.R.H.

N80-24186# Princeton Univ., N. J. Dept. of Electrical Engineering and Computer Science.
STUDY OF ELECTRONIC TRANSPORT AND BREAKDOWN IN THIN INSULATING FILMS
Walter C. Johnson 1 Jun. 1979 74 p refs
(Contract DAAG53-76-C-0059; DARPA Order 3486)
(AD-A081135; NVL-0059-010; STR-7) Avail: NTIS HC A04/MF A01 CSCL 20/12

Recent progress is reported in an ongoing program of studies of high-field effects in thin insulating films on semiconducting substrated. The investigations include further studies of the high-field generation of interface states in the Si-SiO2 system, description of a method for measuring interface state densities at low temperatures, a preliminary report of Auger observations of interface states in the Si-SiO2 system, and the results of further studies of high-field effects in the metal-aluminum oxide-silicon system. GRA

N80-24187# Illinois Univ. at Urbana-Champaign. Dept. of Electrical Engineering.
InGaAsP QUARTERNARY MATERIALS FOR NEAR INFRARED DETECTOR AND LASER APPLICATIONS Quarterly Report, 1 Apr. - 30 Jun. 1979
N. Holonyak, Jr. and G. E. Stillman Jul. 1979 8 p refs
(Contract N00014-77-C-0086; ARPA Order 3316)
(AD-A078320; QTR-8) Avail: NTIS HC A02/MF A01 CSCL 20/12

The study of the influence of different parameters on the growth of InP using the hydride growth technique has been continued. This work is to be presented at the 156th Electrochemical Society Meeting, Los Angeles, 1979, and an abstract is included with the reprints/preprints at the end of this report. Because of moisture damage and contamination sustained during a flood this summer, it was decided to implement the new automatic gas flow control system described in the last report as soon as possible. The old system has been disassembled and heliarc welding on the new system is progressing rapidly. Included at the end of this report are some reprints of papers that have been received since the last report and some preprints and abstracts of more recent work. GRA

N80-24188# Hughes Research Labs., Malibu, Calif.
ELECTRONIC PROCESSES IN InP AND RELATED COMPOUNDS Quarterly Progress Report, 13 Aug. - 12 Dec. 1979
K. V. Vaidyanathan, C. L. Anderson, H. L. Dunlap, D. E. Holmes, and G. S. Kamath Jan. 1980 8 p
(Contract N00019-79-C-0533)
(AD-A080802; QPR-1) Avail: NTIS HC A02/MF A01 CSCL 20/12

An experimental system to measure ionization coefficients in InP and related compounds is described. The growth of high purity liquid phase epitaxial InP is described and the properties of such layers discussed. GRA

N80-24189# Advanced Research and Applications Corp., Sunnyvale, Calif.
IMPROVEMENT IN GaAs DEVICE YIELD AND PERFORMANCE THROUGH SUBSTRATE DEFECT GETTERING Interim Technical Report
T. J. Magee, J. Peng, J. Hong, and R. A. Armistead Jan. 1980 43 p refs
(Contract N00014-78-C-0065; ARPA Order 3516)
(AD-A081344; ARACOR-TR-19-2) Avail: NTIS HC A03/MF A01 CSCL 07/2

The gettering of Cr and front-surfaces defects by mechanically produced back-surface damage in semi-insulating GaAs wafers has been investigated. It has been shown that improved VPE layers can be grown on pre-gettered substrates. Also, the level of Cr outdiffusing from the substrate during epilayer growth and subsequent annealing is substantially reduced when pre-gettered substrates are used. Thermal stability times of back-surface damage at an anneal temperature of 800 C is typically on the order of 2 - 3 hours, corresponding to the point at which major back-surface microstructural damage is largely annealed. Increases in the thermal stability period were attained by encapsulating the back surface with an As-doped SiO2 layer. Subsequent investigations of Au contacts on GaAs showed that Cr was mobile during 350 C alloying, resulting in gettering within alloy damage regions and subsequent outdiffusion into the Au film. Device structures (FET) fabricated on VPE layers on pre-gettered GaAs wafers showed considerable improvements in both yield/wafer, noise figures at higher frequencies and input capacitance values. GRA

N80-24190# Northwestern Univ., Evanston, Ill. Dept. of Materials Science.
PIEZOELECTRICITY IN POLYACRYLONITRILE Interim Report
H. Ueda and S. H. Carr 4 Jan. 1980 30 p refs Submitted for publication
(Contract N00014-75-C-0963; Grant NSF DMR-76-80847; NR Proj. 051-599)
(AD-A081250; TR-8) Avail: NTIS HC A03/MF A01 CSCL 11/9

The piezoelectricity and related properties in ion-doped (NH4NO3, NaNO3) and undoped films of polyacrylonitrile have been measured as a function of temperature. The piezoelectric constants of both ion-doped and undoped films show a maximum around 80 C and thereafter decrease markedly with temperature. A maximum of thermally stimulated discharge current (TSDC) around 90 C is observed in both ion-doped and undoped films. An abrupt decrease of piezoelectric constant around 90 C and TSDC maximum around 90 C are ascribed to randomization of nitrile dipoles in ordered regions. The piezoelectric constant of stretched films has a tendency to increase with stretching. The piezoelectric constant, d sub 31, changes from positive to negative when temperature rises above 110 C. GRA

N80-24191# Electronics Research Lab., Adelaide (Australia).
LIQUID PHASE EPITAXIAL GROWTH OF GALLIUM ARSENIDE
M. Folkard Aug. 1979 42 p refs
(AD-A081835; ERL-0078-TR) Avail: NTIS HC A03/MF A01 CSCL 20/12

This report discusses two methods of liquid phase epitaxial (LPE) growth applied to the compound semi-conductor gallium arsenide, and develops a mathematical description for each using a diffusion-limited model. The properties of the epitaxial layers grown under various experimental conditions are discussed, and the observed growth rates compared with those predicted by the mathematical models. From the differences observed, it is concluded that processes additional to simple diffusion of solute through the melt are occurring. Convective mixing caused by horizontal temperature gradients within the melt is suggested as an explanation for these differences. GRA

N80-24192# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
DENSITY VARIATION IN THE ELECTRON-HOLE LIQUID IN STRESSED GERMANIUM AND SILICON Ph.D. Thesis
Susan Mary Kelso Aug. 1979 385 p refs
(Contract W-7405-eng-48)
(LBL-8786) Avail: NTIS HC A17/MF A01

The variation in electron hole pair density in the electron hole liquid (EHL) in stressed Ge and Si was studied using two procedures. One method involved studying the variation of the density and other properties of the EHL as a function of uniaxial stress in both Ge and Si. The other method involved studying the variation of the density with position in the strain confined electron hole liquid (SCEHL) in Ge. DOE

N80-24193# Lincoln Lab., Mass. Inst. of Tech., Lexington.
HgCdTe AVALANCHE PHOTODIODE DEVELOPMENT Final Report, 1 Aug. 1978 - 30 Sep. 1979
Theodore C. Harman 30 Sep. 1979 29 p refs
(Contract F19628-78-C-0002)
(AD-A081595; ESD-TR-79-309; ARO-15682.1-P) Avail: NTIS HC A03/MF A01 CSCL 09/1

This report covers in detail the mercury cadmium telluride research work carried out on avalanche photodiode development at Lincoln Laboratory for the period 1 August 1978 through 30 September 1979. The topics covered are the liquid phase epitaxial growth of HgCdTe, liquidus isotherm determination by differential thermal analysis, optical and electrical characterization of various epitaxially grown layers on CdTe and CdTeSe substrates. GRA

N80-24194# Illinois Univ., Urbana. Dept. of Physics.
STUDIES IN THE THEORY OF SOLIDS Ph.D. Thesis
H. P. Hjalmarson 1979 263 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1283) Avail: NTIS HC A12/MF A01

The surface sandwich reflectivity, computed by using a method which considers only single reflections of the electron by sheets of atoms in the solid, was directly compared with the slowly varying, surface dependent features in the data. The method was used to determine that the surface of TiS2 is ideal whereas the surface sandwich of TiSe2 expands outward slightly. For the final determinations, the smoothing method was used on both the data and a theory which includes multiple scattering to confine the comparison to just the slowly varying surface dependent features. Energies of deep traps associated with impurities in semiconductors are shown to be controlled by the S and P orbital energies of the impurity atoms. Predictions of energies of deep traps caused by impurities are made for fourteen different semiconductors. The theory is compared with the data for GaP and the alloy GaAs(1-x)Px. A phenomenological model which depends mainly on the energy centers of the valence and conduction band density of states as well as atomic energies of impurities is used to make predictions of deep trap energies in Si. DOE

N80-24195# Ames Lab., Iowa. Dept. of Physics.
VORTICES IN SUPERCONDUCTING FILMS
John R. Clem 1979 7 p refs Presented at the Inhomogeneous Superconductors Conf., Berkeley Springs, W. Va., 1 Nov. 1979
(Contract W-7405-eng-82)
(ISM-258; CONF-791151-1) Avail: NTIS HC A02/MF A01

The local magnetic flux density and electrical current density generated by a vortex in a superconducting film is calculated approximately using an extension of Pearl's method. The results apply to arbitrary ratios of the film thickness to the penetration depth and reduce to Pearl's thin-film and semi-infinite results in the appropriate limits. In addition, the vanishing of the order parameter on the vortex axis is accounted for by a simple model which removes the London-model divergences of the flux density and supercurrent density and leads to a physically correct description in the vortex core. The results are then applied to a calculation of the interaction energy of vortex-vortex and vortex-antivortex pairs. DOE

N80-24196# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
MODEL OF THE RECRYSTALLIZATION MECHANISM OF AMORPHOUS SILICON LAYERS CREATED BY ION IMPLANTATION Ph.D. Thesis
Robert M. Drosd Nov. 1979 96 p refs
(Contract W-7405-eng-48)
(LBL-9990) Avail: NTIS HC A05/MF A01

The recrystallization behavior during annealing of thin films

of amorphous silicon, in contact with a single crystal silicon substrate (referred to as C), was studied in the transmission electron microscope (TEM). The amorphous film is created during high dose phosphorus ion implantation at 100 keV. It was found that the crystal substrate orientation and the implantation temperature have dramatic effects on the recrystallization rate, and the defect microstructure produced during annealing. Specifically, (100) wafers implanted at 77 K contain only a low density of dislocation loops, but when the same wafer is implanted at room temperature the dislocation density is increased drastically. When implanted at 77 K (111) wafers show a high density of microtwins, but as the implantation temperature is increased a gradual increase in the density of dislocation loops is observed along with a reduction of the microtwins. At an implantation temperature of about 100 C both orientations give an identical defect microstructure when annealed, which is a dense tangle of dislocations. DOE

N80-24197# Siemens A.G., Munich (West Germany). Unternehmensbereicht Bauelemente.
LIQUID CRYSTAL DISPLAYS OF HIGH RELIABILITY Final Report
Martin Bechtsler Bonn Bundesmin. fuer Forsch. und Technol. Aug. 1979 106 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. und Technol.
(BMFT-FB-T-79-17) Avail: NTIS HC A06/MF A01; Fachinformationszentrum Energie, Phys., Math., Eggenstein-Leopoldshafen, West Germany DM 21,85

The development of high reliability liquid crystal displays is discussed. The displays feature glass frit sealing, a silicon dioxide protective layer to avoid contamination of the liquid crystal, and a conductive layer bearing. The lifetime of the displays are determined. Author (ESA)

N80-24198# Electronics Research Lab., Adelaide (Australia).
THIN FILM ANNEALING BY ION BOMBARDMENT
E. H. Hirsch and I. K. Varga Aug. 1979 18 p refs
(PB80-125677; ERL-0092-TR; AR-001-701) Avail: NTIS HC A02/MF A01 CSCL 20L

The enhancement of film adherence resulting from argon ion bombardment during the evaporation procedure was studied experimentally. The observations point to the existence of an annealing effect caused by atomic rearrangement in bombardment induced temperature spikes. This mechanism begins to be effective at a critical minimum bombardment intensity, which is sufficient to ensure that practically all the deposited material is subjected to rearrangement soon after it has condensed. The small amount of argon incorporated into the film by the bombardment is shown to have no significant influence on the process. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N80-24199 Rensselaer Polytechnic Inst., Troy, N. Y.
ON VACUUM FLUCTUATIONS OF A SCALAR FIELD IN A LOCALIZED REGION OF SPACETIME Ph.D. Thesis
Richard T. Hammond 1979 88 p
Avail: Univ. Microfilms Order No. 8011504

It is shown that the wavenumber of a scalar field is reduced due to curvature of space. This effect is shown to occur in an Einstein metric, de Sitter space, and the Schwarzchild geometry. Furthermore, it is shown that this effect is more pronounced for higher frequencies and larger curvature. A particle the mass (energy), was modeled by the vacuum energy of a quantized scalar field. The vacuum expectation value of the time-time component of the energy momentum tensor of the scalar field is used in the Einstein field equations. It is then shown that the zero-point energy is not infinite as it appears in flat space but, due to the natural gravitational cutoff, is actually finite. The resulting particle has a mass to radius ratio of that of a black hole. The model is extended by considering a charged particle. If the charge is assumed to be one electronic charge then the resulting particle is a black hole the radius of which is one Planck length and the mass is equal to the Planck mass.
Dissert. Abstr.

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N80-24200*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
MATRIX MANAGEMENT FOR AEROSPACE 2000
John F. McCarthy, Jr. May 1980 16 p refs Presented at the Intern. Meeting and Techn. Display: Global Technol. 2000, Baltimore, 5-11 May 1980
(NASA-TM-81509; E-447) Avail: NTIS HC A02/MF A01 CSCL 05A

The matrix management approach to program management is an organized effort for attaining program objectives by defining and structuring all elements so as to form a single system whose parts are united by interaction. The objective of the systems approach is uncompromisingly complete coverage of the program management endeavor. Starting with an analysis of the functions necessary to carry out a given program, a model must be defined; a matrix of responsibility assignment must be prepared; and each operational process must be examined to establish how it is to be carried out and how it relates to all other processes.
A.R.H.

N80-24201# Naval Postgraduate School, Monterey, Calif.
A MANAGEMENT PERSPECTIVE ON THE ROLE OF INFORMATION PRODUCTION IN THE ORGANIZATION M.S. Thesis
Richard L. Wooten Sep. 1979 53 p refs
(AD-A081058) Avail: NTIS HC A04/MF A01 CSCL 05/1

The explosive growth of information technology in the last decade has caused a demand for experienced information system managers far beyond the present supply. Consequently, many of these positions are filled by personnel who may lack a comprehensive understanding of the role of information production in the organization. This paper addresses organization processes and interactions of which the information system manager must be made aware in order to perform his job effectively. Discussion includes organization purpose, structure, decision processes, and information production. When appropriate, descriptive models were developed in order to better understand the synergistic relationships which exist. Particular attention was given to the need for systematic valuation of organization information products, and development of the 'product-worth function' is proposed as a possible approach to this problem. GRA

N80-24202# Naval Postgraduate School, Monterey, Calif.
A COMPUTER SIMULATION OF ORGANIZATIONAL DECISION-MAKING M.S. Thesis
Vincent John Andrews Dec. 1979 85 p refs
(AD-A081600) Avail: NTIS HC A05/MF A01 CSCL 09/2

A computer simulation of organizational decision-making is developed based on the Complete Cycle of Choice. The interrelationships between attitudes, individual behaviors, organization choices, and the environment are represented in terms of matrices and mathematical equations. Statistical analysis of the data generated by the simulation program is performed to discern

significant variables and decision-making patterns. Refinements to the basic model are proposed to increase its usefulness as a managerial tool. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N80-24203# Forecasting International Ltd., Arlington, Va.
INITIAL CONCEPTUALIZATION AND CHARACTERIZATION OF A NAVY AUTOMATED PUBLISHING, VOLUME 2 Final Report, 15 Feb. - 15 Nov. 1979
Norman Nisonoff and Audrey Clayton Jan. 1980 185 p refs
(Contract N60921-79-C-0106)
(AD-A080479) Avail: NTIS HC A09/MF A01 CSCL 05/2

This report describes an R and D study whose objective was the characterization of an automated publishing system for the Navy which could be introduced during the early 1980s and evolve incrementally to meet by the year 2000 the Navy's needs with regard to the publication of all non-tactical information. Both the methodology and the conclusions of the project are included in the 3 volume report, together with recommendations for Navy actions to develop and test further the concept of such a system. GRA

N80-24204# Defense Technical Information Center, Alexandria, Va.
DTIC CATALOGING GUIDELINES
Barbara P. Gladd Jan. 1980 86 p refs Supersedes DDC/TR-78/3
(AD-A080800; DTIC-TR-80/1; DDC/TR-78/3) Avail: NTIS HC A05/MF A01 CSCL 05/2

Defense Technical Information Center (DTIC) rules for cataloging of reports for computer entry are arranged in numeric order by the number designations of the computer fields described. Data regarding space limitations for each field are provided. Additional fields have been added to previous edition to include regrading of classified reports to implement EO 12065 effective 1 December 1978. These rules are an adaptation of Guidelines for Descriptive Cataloging of Reports, A Revision of COSATI Standard for Descriptive Cataloging of Government Scientific and Technical Reports, published in March 1978 as AD-A050900. Subject fields and groups, abstracts, posting terms and candidate posting terms are discussed briefly. Included is an appendix from COSATI of personal author surnames with separately written prefixes, as well as several appendices designed for use by trainee catalogers. GRA

N80-24205# Midwest Research Inst., Golden, Colo. Solar Energy Research Inst.
TECHNICAL INFORMATION DISSEMINATION PLAN FOR THE US DEPARTMENT OF ENERGY, ETS/SOLAR DIVISIONS
Pete Mourning, Barbara Glenn, Stephen A. Rubin, F. Floyd Shoemaker, and Rob Soto Jan. 1979 74 p
(Contract EG-77-C-01-4042)
(SERI/SP-69-071) Avail: NTIS HC A04/MF A01

A plan for a technical information dissemination (TID) program is presented, the purpose of which is to build the most effective information transfer mechanisms possible to support the earliest appropriate commercialization of solar research and development (R&D) results in five technologies: photovoltaics, solar thermal power, biomass, ocean thermal energy conversion, and wind energy conversion. Coordination, evaluation, and maximum use of ongoing information support services, information activities where the leverage effect appears reasonably high in meeting the goals of the TID program, and involvement of in house and contractor personnel in planning, evaluating, and implementing these technical information dissemination activities are described. Users of solar R&D results are to be involved in external evaluation of technical information activities in each of the five solar technologies. DOE

N80-24206# Rolls-Royce Ltd., Derby (England).
THE MANAGEMENT OF INFORMATION FLOW IN A HIGH TECHNOLOGY DEVELOPMENT ENVIRONMENT
D. S. Pearson 1979 28 p refs
(PNR-90002) Avail: NTIS HC A03/MF A01

Methods for planning, motivating, and managing applied to the activities of technical personnel engaged in a gas turbine development program are described. Average value for numbers of projects begun, the fraction finally reported on, and manhours available for each project were gathered from records of instrumentation tests conducted during a period of 25 years. The data were for modeling anticipated situations, permitting effective assignment of resources. Author (ESA)

N80-24207# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
SYSTEM REQUIREMENTS ANALYSIS FOR THE CHEMICAL STRUCTURE AND NOMENCLATURE SYSTEM (CSNS) Final Report
David Lefkovitz, Helen N. Hill, and Carol S. Kulp 28 Sep. 1979 234 p refs
(PB80-105216) Avail: NTIS HC A11/MF A01 CSCL 05B

The Chemical Structure and Nomenclature System (CSNS) which will enable Chemical Substances Information Network (CSIN) users to determine whether a particular chemical substance exists in the network is presented. A plan for CSNS development, including functional and operational requirements, design alternatives, existing systems, and a developmental approach, is presented. GRA

N80-24208# General Services Administration, Washington, D.C.
HONEYWELL INFORMATION SYSTEMS MULTICS VERSION 4.1
18 Jan. 1980 79 p
(PB80-126071; CCVS74-VSR470) Avail: NTIS HC A05/MF A01

This validation summary report (VSR) for the HIS LEVEL 68 MULTICS COBOL compiler Version 4.1 (MULTICS Version MR7.0B) provides a consolidated summary of the results obtained from the validation of the subject compiler against the 1974 COBOL Standard (X323-1974/FIPS PUB 21-1). The compiler was validated at the high level of FIPS PUB 21-1. The VSR is made up of several sections showing the discrepancies found. These include an overview of the validation which lists all categories of discrepancies be level/module within X3.23-1974, a section relating the categories of discrepancies to each of the Federal levels of the language; and a detailed listing of discrepancies together with the tests which were failed. GRA

N80-24209# Hotline International, New York, N.Y.
HOW TO GAIN ACCESS TO INFORMATION ON SCIENCE AND TECHNOLOGY FOR DEVELOPMENT FROM DATA BASES VIA COMPUTER TELECOMMUNICATIONS
Glen Leet Aug. 1979 47 p refs Presented at the UN Conf. on Sci. and Technol. for Develop., Vienna, Aug. 1979
(PB80-133143) Avail: NTIS HC A03/MF A01 CSCL 05B

The use of computers and the telecommunications systems to improve access to information in developing countries are considered. Computer access to data banks is demonstrated. A plan for practical demonstrations of the transfer of information on Science and Technology for development via computer telecommunications is given. The augmentation of international conferences through computer communications is discussed. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N80-24210# Committee on Commerce, Science, and Transportation (U. S. Senate).
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION AUTHORIZATION ACT, 1981
15 May 1980 20 p A bill referred to the Comm. on Com., Sci., and Transportation, 96th Congr., 2nd Sess., 30 Jan. 1980 (S-96-719) Avail: US Capitol, Senate Document Room

An ammendment is presented to the text of a bill authorizing appropriations to the National Aeronautics and Space Administration for research and development, construction of facilities, and research and program development. A.R.H.

N80-24211# Committee on Science and Technology (U. S. House).
NASA AUTHORIZATION, 1981
Washington, D.C. GPO 1980 316 p refs Hearings before the Subcomm. on Transportation, Aviation and Commun. of the Comm. on Sci. and Technol., 96th Congr., 2nd Sess., no. 95, v. 3, 6-7 Feb. 1980
(GPO-59-528) Avail: Subcommittee on Transportation, Aviation and Communications

Specifics of NASA'S proposed aeronautics program are discussed with emphasis on research and technology development in aerodynamics, materials and structures propulsion, avionics, and human factors engineering. Benefits accrued from the ACEE program are examined and activities related to the defense program are summarized. A.R.H.

N80-24212# Comision Nacional de Investigacion del Espacio, Madrid.
[SPACE RESEARCH ACTIVITIES IN SPAIN]
1979 50 p Presented at 22nd COSPAR Plenary Meeting, Bangalore, India, 29 May - 9 Jun. 1979 Original contains color illustrations
Avail: NTIS HC A02/MF A01

The following activities of the Commission are described: research in meteorology; the ionosphere; astrophysics and radioastronomy; cosmic rays; remote sensing; the Spacelab experiment and operation of the rocket launching station El Aronosillo. Developments in sounding rockets, hydrazine thrusters, spectra of fluorescence of gases, as well as the operation of the Madrid Space station are outlined. Author (ESA)

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N80-24213*# Stanford Univ., Calif. Dept. of Engineering-Economic Systems.
RESEARCH ON THE APPLICATIONS OF SPACE TECHNOLOGY Final Report
Oct. 1979 343 p refs
(Grant NASw-3204)
(NASA-CR-153184) Avail: NTIS HC A15/MF A01 CSCL 05A

Communication satellites and technology transfer are discussed in seven individual reports. Topics cover: (1) NASA'S technological alternatives assuming that the orbit-spectrum resource will continue to be allocated to communication satellite service providers at zero price; (2) the economic aspects of orbit-spectrum allocation; (3) the cost structure of local distribution systems for satellite communication; (4) the economic basis for national science and technology policy; (5) the economics of the household economy; (6) government patent policy; and (7) screening and evaluation in information dissemination.A.R.H.

N80-24214# Los Alamos Scientific Lab., N. Mex.
FUEL CELL SYSTEMS FOR VEHICULAR APPLICATIONS
D. K. Lynn, J. B. McCormick, R. E. Bobbett (Arizona Univ., Tuscon), W. J. Kerwin, and C. Derogin 1980 30 p refs Presented at SAE Automotive Eng. Congr. and Exposition, Detroit, 25 Feb. 1980
(Contract W-7405-eng-36)
(LA-UR-79-2826; CONF-800202-2) Avail: NTIS HC A02/MF A01

The phosphoric acid fuel cell was used as the base line in these evaluations. Two cell sizes (15 and 60 kW) and two fuel options (methanol and propane) were included. Four vehicle types, the city bus, highway bus, delivery van, and general-purpose consumer car were selected for evaluation. Typical drive cycles and economics for these vehicles are compiled, and the fuel cell vehicle and current internal combustion and diesel engine vehicles are compared. The initial results of detailed computer simulations to illustrate a number of the important system-design considerations in configuring a fuel cell/battery electric vehicle are presented and a fuel-cell-powered golf cart currently being used as an engineering test bed is described. DOE

N80-24215# Energy Research Corp., Danbury, Conn.
RESEARCH, DEVELOPMENT, AND DEMONSTRATION OF NICKEL-ZINC BATTERIES FOR ELECTRIC VEHICLE PROPULSION Annual Report
Oct. 1979 139 p
(Contract W-31-109-eng-38)
(ANL/OEPM-78-10) Avail: NTIS HC A07/MF A01

Progress in the nickel electrode development program directed at the optimization of the electrical performance, specifically, in terms of increased cycle life is reported. Pilot plant facilities to produce nickel hydroxide, manufacturing processes to produce nickel hydroxide and the effect of additives upon shape change, cycle performance and on the mechanistic processes involved in the shape change are covered along with a low cost separator which exhibits stability in the electrolyte, has uniform pores which are of a sufficiently small size to impede the growth of zinc dendrites, and exhibits low electrical resistance and good flexibility. The feasibility of sealed cell operation is also examined. Results of accelerated testing are presented. DOE

N80-24216# Department of Energy, Washington, D. C. Office of Transportation Programs.
ELECTRIC AND HYBRID VEHICLE PROGRAM Quarterly Report, Jul. - Sep. 1979
Nov. 1979 27 p
(Contract EC-77-A-31-1044)
(DOE/CS-0026) Avail: NTIS HC A03/MF A01

Progress in U.S. programs on the design, development, production, performance testing, and commercializing of electric and hybrid electric powered vehicles is briefly summarized. DOE

N80-24217# Argonne National Lab., Ill.
ELECTRIC AND HYBRID VEHICLES IN THE URBAN FUTURE
Margaret K. Singh and Martin J. Bernard, III 1979 11 p refs Presented at the 2nd Intern. Conf. on Energy Use Management, Los Angeles, 22-26 Oct. 1979
(Contract W-31-109-eng-38)
(CONF-791009-23) Avail: NTIS HC A02/MF A01

Basic electric and hybrid vehicle (EHV) information is outlined for transportation energy planners and engineers. Topics covered include: (1) the market potential for EHVs (trucks, buses, and automobiles) based on the work of several research groups and on expected technological characteristics of EHVs; (2) an assessment of the impact of EHVs on the urban structure and transport systems as well as urban environmental systems; and (3) current programs designed to accelerate the utilization of EHVs. In the assessment, 61 types of vehicles are characterized and set in five distinct market scenarios. It is concluded that the potential for significant EHV markets by the year 2000 is high and an overall net benefit to urban areas will result. DOE

N80-24218# Environmental Protection Agency, Ann Arbor, Mich. Standards Development and Support Branch.
FUEL CONSUMPTION MEASUREMENTS-CARBON BALANCE VERSUS FLOW METER
Dale Turton Jul. 1979 10 p ref
(PB80-128549; EPA-AA-SDSB-79-28) Avail: NTIS HC A02/MF A01 CSCL 13F

Fuel consumption data obtained by both the carbon balance method and the fuel flow method is described and compared. A recent EPA program which investigated the accuracy of the dynamometer simulation of the speed of a vehicle consisted of numerous repetitive steady, state dynamometer tests, providing sufficient fuel consumption measurements by both methods for the statistical analysis necessary to detect any difference between the methods. GRA

N80-24255 Purdue Univ., Lafayette, Ind. Dept. of Mechanical Engineering.
VEHICLE-GUIDEWAY INTERACTION PROBLEMS
J. Genin and E. C. Ting *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 3-10 refs (For primary document see N80-24254 14-99)
Avail: NRL, code 8404. Shock and Vibration Inform. Center, Washington D.C. 20375. Annual rate $100.00

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N80-24219 Clemson Univ., S.C.
OBSERVATIONS AND ANALYSIS OF FOUR ECLIPSING BINARY SYSTEMS Ph.D. Thesis
William Clarence Maddox 1979 123 p
Avail: Univ. Microfilms Order No. 8010560

Four eclipsing binary systems were observed in order to determine times of minimum light and conduct period studies. Three of these, in the constellation Ophiuchus, are W Ursae Majoris-type eclipsing binaries. The fourth, R W Tauri, is an Algol-type system. V502 Oph was analyzed using the Russell-Merrill and Wilson-Devinney methods. R W Tauri was analyzed using the Wilson-Devinney method. Dissert. Abstr.

N80-24220 Texas Univ. at Austin.
VACUUM BLACK HOLE GRAVITATIONAL WAVE CROSS SECTIONS Ph.D. Thesis
Francis Albert Handler 1979 145 p
Avail: Univ. Microfilms Order No. 8009864

The problem of scattering of plane gravitational waves incident along the z axis of a Kerr black hole was solved numerically. Analogies between the problem and several simplified problems are exploited to provide intuitive understanding of the features seen in the scattering cross sections. Partial wave absorption as a function of lambda provided a measure of marginally trapped null trajectories characterized by an asymptotic impact parameter. The parameter was found to be larger for the case of corotation between the incoming wave and hole than for the counter rotating case. Interpretation of the differential cross section was further achieved using a semiclassical viewpoint borrowed from quantum scattering. Dissert. Abstr.

N80-24221 Colorado Univ. at Boulder.
THE SHELL EPISODE OF 59 CYGNI (1974-1975): ROTATING MAGNETIC WINDS? Ph.D. Thesis
Paul Kenneth Barker 1979 238 p
Avail: Univ. Microfilms Order No. 8011263

High quality spectroscopic observation obtained of the early Be star 59 Cygni during an active phase characterized by mass ejection and a 160-day shell episode are examined. Shell absorption lines are shown to display variations in strength and velocity which have a form radically different from the variations seen in Pleione. The nonlinear hydrodynamic equations governing a radiatively driven rotating magnetic stellar wind are solved numerically. An extensive grid of quasi-static subcritical model winds is calculated for both a hard force law and a new semi-soft force law, for a variety of mass loss rates and magnetic field strengths, with and without rotation. The terminal velocities of both hard and semi-soft winds are sensitive to changes in the wind parameters. Semi-soft winds are more sensitive than hard winds: such a wind from a rapidly rotating star with a photospheric field of 20 gauss can have a terminal velocity a factor of four lower that the wind from an identical nonrotating nonmagnetic star. Variability in either the mass loss rate or the magnetic field can explain the large wind velocity changes observed in 59 Cygni. Dissert. Abstr.

N80-24222# California Univ., San Diego, La Jolla. Dept. of Physics.
GROUND-BASED MEASUREMENTS OF SOURCES IN THE AFGL INFRARED SKY SURVEY Final Report, 1 Aug. 1976 - 15 Nov. 1979
Richard J. Rudy, Timothy R. Gosnell, and S. P. Willner 15 Nov. 1979 73 p refs
(Contract F19628-76-C-0252; AF Proj. 7670)
(AD-A081381; AFGL-TR-79-0172) Avail: NTIS HC A04/MF A01 CSCL 03/1

This report contains ground-based observations of 271 objects detected in the AFGL infrared sky survey, falling between 40 min. and 60 min. of each hour of right ascension and -60 deg and -30 deg of declination. Photometric magnitudes are presented for those sources which could be located from the ground and are compared to those reported by the Air Force. Conclusions are drawn concerning the identification of AFGL sources with IRC sources. A rough classification is made of the catalogue objects within our area of the sky. Limits for completeness of the survey are approximately -1.0 mag at 4 micrometers and -1.0 mag at 11 micrometers. GRA

N80-24223# Los Alamos Scientific Lab., N. Mex.
PULSATION OF HIGH LUMINOSITY HELIUM STARS
D. S. King, J. C. Wheeler (NBS, Boulder, Colo.), J. P. Cox (NBS, Boulder, Colo.), A. N. Cox, and S. W. Hodson 1979 12 p refs Presented at the Nonradial and Nonlinear Stellar Pulsation Workshop, Tucson, Ariz., 12 Mar. 1979 Submitted for publication
(Contract W-7405-eng-36)
(LA-UR-79-2785; CONF-790364-4) Avail: NTIS HC A02/MF A01

Preliminary calculations are made on a systematic restudy of the linear and nonlinear pulsations of helium stars allowing for more recent and higher estimates of the effective temperature and for the high carbon abundance. Linear and nonlinear models are used. Results show qualitative agreement with earlier ones, models with sufficiently large L/M have a very hot blue edge for their instability strip, very large L/M values lead to dynamically unstable models which would appear to eject mass and therefore may not be realistic models for the pulsating RCrB stars, for the sequence studied a reasonable mass could be > or = 1.5 M sub solar. DOE

N80-24224# Los Alamos Scientific Lab., N. Mex.
LASL GAMMA-RAY BURST ASTRONOMY PROGRAM
R. W. Klebesadel, W. D. Evans, and J. R. Laros 1979 13 p refs Presented at the Conf. on Cosmic Gamma Ray Bursts, Toulouse, 25-30 Nov. 1979
(Contract W-7405-eng-36)
(LA-UR-80-90; CONF-791164-1) Avail: NTIS HC A02/MF A01

Satellite observation of cosmic gamma burstss are reviewed. The vela, Pioneer Venus, and ISEE-3 instruments observation are discussed. DOE

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N80-24225 Pennsylvania State Univ., University Park.
THEORETICAL INVESTIGATION OF STATIONARY STELLAR SYSTEMS IN THE BRANS-DICKE THEORY OF GRAVITATION, WITH APPLICATIONS TO PERFECT FLUID INTERIORS Ph.D. Thesis
William Fred Bruckman 1979 276 p
Avail: Univ. Microfilms Order No. 8008083

Stationary stars in the Brans-Dicke-Jordan theory of gravitation were modeled and studied. Cold, superdense, perfect fluid configurations were investigated and exact and approximate solutions were found which suggest that there is a maximum mass for cold matter beyond which equilibrium cannot be achieved. Methods for generating Brans-Dicke-Jordan solutions from known solutions of general relativistic perfect fluids and from Einstein-Maxwell equations, are presented. The stability of equilibrium configurations was studied using a critical based on energy considerations alone and the case of radial perturbations of spherically symmetric perfect fluids in general relativity is discussed. Dissert. Abstr.

N80-24226 Ohio State Univ., Columbus.
EVOLUTION OF A SUPERMASSIVE OBJECT ACCRETING MASS Ph.D. Thesis
Robert Charles Reynolds 1979 289 p
Avail: Univ. Microfilms Order No. 8009333

The evolution of a supermassive star accreting mass is studied. The range of masses considered is 100,000 to 1,000,000 M with an accretion rate of 10 to the 27th power gm/sec and an infall velocity for the accreting material of 100,000,000 cm/sec. The dynamical behavior of nonvacuum and vacuum models were analyzed in three short time step sequences. Dissert. Abstr.

N80-24227 State Univ. of New York at Stony Brook.
HELIUM ABUNDANCES IN YOUNG CLUSTERS AND ASSOCIATIONS Ph.D. Thesis
Gail Yanchak Patton 1979 179 p
Avail: Univ. Microfilms Order No. 8011072

Helium abundances derived from high dispersion spectrograms of 80 early B stars are discussed. These objects are members of seven young clusters and two associations which span a range of galactocentric radius of nearly four kilopersecs. It is assumed that each cluster is characterized by a unique helium abundance which reflects that of the interstellar medium from which the cluster condensed. An estimate of this abundance can be obtained from the mean of the helium abundance determined from the individual B stars in a cluster. Comparison of the cluster means shows a range in abundances of 086 < or = N(He) < or = .107. However, the inclusion of undetected spectroscopic binaries may have a substantial effect on the cluster mean helium abundance. A method of indentifying suspected systems in the observed clusters is proposed. A strong upper limit is placed on a possible helium abundance gradient in the Galaxy indicating a mean abundance of N(He) = .097 + or - .002 for B stars. Assuming helium enhancement by nuclear processing of an amount similar to the observed metal enhancement in Population I objects yields Y sub P = .24, within the predicted range of Big Bang cosmology. Dissert. Abstr.

N80-24228 Texas Univ. at Austin.
RAPID OSCILLATIONS IN CATACLYSMIC VARIABLES Ph.D. Thesis
Joseph Otis Patterson 1979 239 p
Avail: Univ. Microfilms Order No. 8009910

The rapid oscillations seen in the optical light curves of cataclysmic variables are examined. The discovery of a class of rapid periodic variable is noted of which DQ Herculis is the prototype. There are four members of this class: two classical novae, one nova-like variable, and one dwarf nova. Their periods range from 28 to 71 seconds, and their oscillations are essentially permanent features of the light curves. The oscillations are extraordinarily stable in period and phase, showing measurable changes only on time scales of years. A comprehensive study of the coherent oscillations seen in the eruption light curves of dwarf novae is also presented. The oscillations are typically seen for a few days near the peak of each dwarf nova eruption. The periods are in the range 8 to 39 seconds, with each star showing a characteristic, and much smaller, range of variation. Finally, a unified model is proposed in which both the DQ Her-type and the dwarf nova oscillations can be produced by the same basic mechanism in rapidly rotating white dwarfs with magnetic fields of 10 to the 5th to 10 to the 8th power gauss, and with time varying accretion rates. Dissert. Abstr.

N80-24229 California Inst. of Tech., Pasadena.
STUDIES ON GRAVITATIONAL WAVES AND STARS WITH NEUTRON CORES Ph.D. Thesis
Mark Edward Zimmerman 1980 180 p
Avail: Univ. Microfilms Order No. 8010968

Estimates of the astrophysically likely amplitude of gravitational radiation emitted by the Crab and Vela pulsars are presented. The pulsars are modeled as rapidly rotating, freely precessing, rigid or elastic solid bodies. The gravitational radiation produced by an idealized rotating and freely precessing rigid body were studied in the weak field, slow motion, small stresses, quadrupole moment formalism. A natural coordinate system which might be set up by a rotating and accelerating observer is presented and the results in studying nucleosynthesis in stars with neutron star cores are discussed. Dissert. Abstr.

N80-24230 Harvard Univ., Cambridge, Mass.
CHARGE TRANSFER PROCESSES IN ASTROPHYSICAL PLASMAS Ph.D. Thesis
Scott Edward Butler 1979 180 p
Avail: Univ. Microfilms Order No. 8011105

Charge transfer recombination and ionization processes which occur in astrophysical plasmas are investigated. The electronic structure and the couplings which describe the reactions quantum mechanically are studied via the methods of quantum chemistry. Calculations are presented for most astrophysically important charge transfer processes. The significance of each of the couplings which can induce charge transfer is discussed. Rate coefficients calculated by a variety of means are presented, and simple methods based upon the full quantal results are developed to allow the estimation of other rate coefficients. The significance of the process for a wide variety of astronomical objects is pointed out, and the specific effects of charge transfer upon the determination of the neon abundance in planetary nebulae, astrophysical shocks, and the interpretation of the spectral lines of silicon ions are discussed. Dissert. Abstr.

N80-24231# National Technical Information Service, Springfield, Va.
COSMOLOGY: CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jan. 1980
Brian Carrigan Feb. 1980 151 p Supersedes NTIS/PS-79/0118; NTIS/PS-78/0089; NTIS/PS-77/0116 (PB80-804818; NTIS/PS-79/0118; NTIS/PS-78/0089; NTIS/PS-77/0116) Avail: NTIS HC $30.00/MF $30.00 CSCL 03B

Studies of cosmology and cosmological models are cited. The origin of the universe is studied by the aid of nuclear reactions, relativity, and astrophysical research. This updated bibliography contains 144 abstracts, 16 of which are new entries to the previous edition. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N80-24232 Texas Univ. at Dallas.
ANALYSIS OF LUNAR SEISMIC SIGNALS: DETERMINATION OF INSTRUMENTAL PARAMETERS AND SEISMIC

VELOCITY DISTRIBUTION Ph.D. Thesis
Peter Horvath 1979 346 p
Avail: Univ. Microfilms Order No. 8010640

Inverse filters, designed to correct for the instrumental response and for near surface effects to facilitate the comparison of the ground motion at the various sites on the lunar surface are described. The constants of the long period lunar seismographs were determined from a least squares inversion of the observed calibration pulses. The noise, especially the digitizing noise, was reduced by using two postive and two negative calibration pulses. The seismograph parameters allowed calculation of the transfer functions for each seismograph and accurate correction of the seismograms for the instrumental response. The seismograms were corrected for both instrumental response and near surface effect and were found to be comparable at the various sites and were used to obtain readings for the direct shear and secondary wave arrivals. Dissert. Abstr.

N80-24233 Brown Univ., Providence, R. I.
STUDIES OF IMPACT CRATERING PROCESSES Ph.D. Thesis
Mark Frederick Patrick Settle 1979 189 p
Avail: Univ. Microfilms Order No. 8007061

Impact cratering processes on the Moon and the terrestrial planets are examined. The effects of various modification processes that occur during the terminal stages of an impact cratering event are assessed. The distribution characteristics and mode of emplacement of impact crater ejecta are discussed.
Dissert. Abstr.

N80-24234 Brown Univ., Providence, R. I.
EVOLUTION OF THE EARLY LUNAR CRUST: THE ROLE OF IMPACT MELTING, SECONDARY CRATERING, AND HIGHLAND VOLCANISM Ph.D. Thesis
Bernard Ray Hawke 1979 108 p
Avail: Univ. Microfilms Order No. 8007017

The processes associated with impact melting, secondary cratering and highland volcanism are examined and their implications for the evolution of the early lunar crust are discussed. Investigations of lunar impact melt deposits have yielded results concerning melt distribution and modes of occurence as well as the processes responsible for melt emplacement. Criteria for the identification of melt deposits were formulated and an origin as the product of shock melting was confirmed. The modes of occurance, distribution, and amounts of melt were analyzed and found to vary as a function of crater size. A model for the emplacement of large amounts of impact melt on crater rims, which places emphasis on events occuring during the modification stage of the cratering process is presented. Dissert. Abstr.

N80-24235 California Inst. of Tech., Pasadena.
Sm-Nd AND Rb-Sr CHRONOLOGY OF CRUSTAL FORMATION. PART 1: Ba, Nd AND Sm ISOTOPIC ANOMALIES IN THE ALLENDE METEORITE, PART 2 Ph.D. Thesis
Malcolm Thomas McCulloch 1980 400 p
Avail: Univ. Microfilms Order No. 8010964

The times at which new segments of crust were formed ascertained by using Sm-Nd and Rb-Sr isotopic systematics, together with plausible assumptions regarding the geochemical evolution of the crust and mantle. The general approach used is to assume that the differentiation process which produce magmatic rocks occur with a marked chemical fractionation of the Sm/Nd and Rb/Sr ratios relative to the source region. It is then the time of this chemical fraction which has been dated. This approach is valid insofar as the dominant contribution to the crust comes from emplacement of magmatic rocks derived from a 'uniform' mantle reservoir. Isotopic anomalies are reported for Ba, Nd, and Sm in two inclusions from the Allende meteorite. These inclusions are typical Ca-Alrich objects associated with early condensates from the solar nebula but have distinctive O and Mg isotopic anomalies of FUN type. Dissert. Abstr.

N80-24236*# RAND Corp., Santa Monica, Calif.
IMPROVED COORDINATES OF FEATURES IN THE VICINITY OF THE VIKING LANDER SITE ON MARS
Merton E. Davies and Stephen H. Dole Mar. 1980 21 p refs
(Contract NASw-3264)
(NASA-CR-153193: RAND/R-2600-NASA) Avail: NTIS HC A02/MF A01 CSCL 03B

The measurement of longitude of the Viking 1 landing site and the accuracy of the coordinates of features in the area around the landing site are discussed. The longitude must be measured photogrammatically from the small crater, Airy 0, which defines the 0 deg meridian on Mars. The computer program, GIANT, which was used to perform the analytical triangulations, and the photogrammetric computation of the longitude of the Viking 1 lander site are described. Improved coordinates of features in the vicinity of the Viking 1 lander site are presented. E.D.K.

N80-24237# Technische Universitaet, Munich (West Germany). Lehrstuhl fuer Raumfahrttechnik.
MARS
Harry O. Ruppe Jan. 1977 32 p refs In GERMAN
(TUM-LRT-KB-13/77) Avail: NTIS HC A03/MF A01

A historical review of the study of Mars is presented. The surface features of the planet and its moons are described. The exploration of the solar system with space probes is discussed, with emphasis on Mars. Author (ESA)

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N80-24238 Colorado Univ. at Boulder.
INTERNAL GRAVITY WAVES IN THE SOLAR ATMOSPHERE Ph.D. Thesis
Barbara Ruth Mihalas 1979 322 p
Avail: Univ. Microfilms Order No. 8011292

Three aspects of the behavior of gravity waves in the solar atmosphere are considered adiabatic propagation in the photosphere and chromosphere; photospheric radiative damping of waves generated by convection; and the effects of waves on spectral line profiles. The wave propagation studies are carried out with linearized fluid equations in a standard solar model. The fluid equations are reduced to a single Schroedinger-type equation in the vertical velocity, which is solved as a two-point boundary-value problem. Wave perturbations derived from this solution are used in a line transfer code to study effects of waves with varying parameters on spectra line profiles.
Dissert. Abstr.

N80-24239 Colorado Univ. at Boulder.
THE EFFECT OF TRANSPORT PHENOMENA ON ELECTRON VELOCITY DISTRIBUTION FUNCTIONS AND ION ABUNDANCES IN THE SOLAR CHROMOSPHERE-CORONA TRANSITION REGION Ph.D. Thesis
Robert Antoine Roussel-Dupre 1979 293 p
Avail: Univ. Microfilms Order No. 8011301

The effect of non Maxwellian electron distribution functions on ionization equilibrium calculations for ions found in the solar atmosphere and the effects of diffusion on ion abundances in the chromosphere-corona transition region were studied. The electron distribution functions were estimated as a function of height for Dupree's model of the transition region. The results were used to compute ionization rates for ions of carbon nitrogen and oxygen. The effect of thermal diffusion on ion abundances in the solar transition region is discussed. Diffusion coefficients for ions of helium, carbon, nitrogen and oxygen were computed.
Dissert. Abstr.

N80-24240*# Nielsen Engineering and Research, Inc., Mountain View, Calif.
APPLICATION OF ADVANCED COMPUTATIONAL PROCEDURES FOR MODELING SOLAR-WIND INTERACTIONS WITH VENUS: THEORY AND COMPUTER CODE Progress Report, Jul. 1978 - Sep. 1979
Stephen S. Stahara, Daniel Klenke, Barbara C. Trudinger, and John R. Spreiter May 1980 318 p refs
(Contract NASw-3182)
(NASA-CR-3267; NEAR-TR-202) Avail: NTIS HC A14/MF A01 CSCL 03B

Computational procedures are developed and applied to the

prediction of solar wind interaction with nonmagnetic terrestrial planet atmospheres, with particular emphasis to Venus. The theoretical method is based on a single fluid, steady, dissipationless, magnetohydrodynamic continuum model, and is appropriate for the calculation of axisymmetric, supersonic, super-Alfvenic solar wind flow past terrestrial planets. The procedures, which consist of finite difference codes to determine the gasdynamic properties and a variety of special purpose codes to determine the frozen magnetic field, streamlines, contours, plots, etc. of the flow, are organized into one computational program. Theoretical results based upon these procedures are reported for a wide variety of solar wind conditions and ionopause obstacle shapes. Plasma and magnetic field comparisons in the ionosheath are also provided with actual spacecraft data obtained by the Pioneer Venus Orbiter. E.D.K.

N80-24241# Manila Observatory (Philippines).
SOLAR MICROWAVE BURSTS ACCOMPANYING PROTON EVENTS Final Report, 1 Jul. 1977 - 30 Jun. 1979
Victor L. Badillo 31 Jul. 1979 22 p ref
(Contract F19628-77-C-0200; AF Proj. 4643)
(AD-A081461; AFGL-TR-79-0171) Avail: NTIS HC A02/MF A01 CSCL 03/2

A daily radio patrol was maintained at Manila Observatory. The cm sun was monitored at discrete frequencies: 8800, 4995, 2695, 1415 and 606 MHz, while the dekameter sun was monitored by a sweep frequency interferometer in the band 24-48 MHz. Microwave bursts accompanying six proton events are shown. GRA

N80-24242# California Univ., San Diego, La Jolla. Dept. of Electrical Engineering and Computer Sciences.
THE LATITUDINAL STRUCTURE OF SOLAR WIND STREAMS FROM RADIO SCINTILLATION OBSERVATIONS
S. Ananthakrishnan, W. A. Coles, J. J. Kaufman, and B. J. Rickett Hanscom AFB, Mass. AFGL Sep. 1979 37 p refs
(Contract F19628-77-C-0161; AF Proj. 2311)
(AD-A081462; AFGL-TR-79-0234; SR-2) Avail: NTIS HC A03/MF A01 CSCL 03/2

A comparison of spacecraft and IPS(Interplanetary Scintillations) measurements of the solar wind velocity for 1973-75 are presented, when the large scale velocity structure was very stable. From this comparison we infer a prototype distribution across a high speed stream for the electron density fluctuations, delta n sub e, in the spatial frequency range 1/10,000 - 1/100/km. The 'microturbulence' is more closely related to the velocity structure in a stream than to the bulk density; enhancements in delta n sub e occur wherever high speed wind overtakes low speed wind. The distribution of delta n sub e is closely matched by the distribution of magnetic field fluctuations approx. 1/1,000,000 km. GRA

N80-24243# Los Alamos Scientific Lab., N. Mex.
SOLAR PHOTO RATE COEFFICIENTS
W. F. Huebner and C. W. Carpenter Oct. 1979 97 p refs
(Contract W-7405-eng-36)
(LA-8085-MS) Avail: NTIS HC A05/MF A01

Photo rate coefficients based on wavelength dependent solar photon flux at 1 AU heliocentric distance were determined for atomic hydrogen, carbon, nitrogen, and oxygen, and for some molecules formed from these elements. Branching ratios are considered for the various modes of decay of these molecules. Rates for some metastable states were estimated. DOE

N80-24244# California Univ., Livermore. Lawrence Livermore Lab.
HISTORY OF THE SUN'S LUMINOSITY, 0 TO 460,000 BP, BASED ON THE GEOLOGIC RECORD IN LIGHT OF RECENT CLIMATE THEORY
J. A. Viecelli Jan. 1980 17 p refs Presented at the 17th Gen. Assembly of the Intern. Union of Geodesy and Geophys., Canberra, Australia, Dec. 1979 Revised
(Contract W-7405-eng-48)
(UCRL-80972-Rev-2; CONF-791231-1) Avail: NTIS HC A02/MF A02

A solar luminosity index extending 460,000 years into the past is computed from ocean surface temperatures derived from the geologic record. It is estimated that the Sun's luminosity fluctuated between 2% above to 5% below the current value over this period. The index shows pulses occurring at intervals of 75,000 to 120,000 years. DOE

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N80-24245 California Univ., San Diego.
THE SOLAR IMPULSIVE HARD X-RAY SPECTRUM Ph.D. Thesis
Michael John Elcan 1979 195 p
Avail: Univ. Microfilms Order No. 8009750

The solar impulsive hard X-ray spectrum is described using both the power law and the exponential forms and presents a high temperature thermal flare model to account for the data. The data set consists of 219 10.24 sec samples in 38 small to medium size flares. Systematic data reduction error was minimized by using a complete detector model appropriate to both the spectral form and the parameters for each individual sample. The exponential results is compared to previous uses of a power law. Mechanisms for rapidly and efficiently producing a Maxwellian plasma are examined. Adiabatic compression expansion is dicussed. Dissert. Abstr.

N80-24246# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR).
THE COLLECTIVE ACCELERATION MECHANISM OF SOLAR COSMIC RAYS
S. S. Gershtein 1978 21 p refs Submitted for publication (IFVE-OTF-78-112) Avail: International Atomic Energy Agency, Karntner, Ring 11, P.O. Box 590, A-1011 Vienna, Austria

The collective acceleration mechanism of protons and nuclei in solar flares, which lies in the fact that nuclei are trapped by electron bunches moving along the opened lines of force of the decreasing magnetic field of spots, is discussed. The proposed mechanism explains in a natural way the electron and nucleus energy ratio observed during flares. Electron acceleration in the current layers up to energies of the order of a MeV is discussed as a mechanism of electron pulsed injection. The collective acceleration mechanism can be realized at a comparatively small density of the accelerated electrons. Author

99 GENERAL

N80-24247 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 8
Judith Nagle-Eshleman, ed. Aug. 1979 83 p refs
(AD-A073239) Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Current sound, and vibration literature is critiqued and summarized. Review articles concerning acoustic waves and low wavenumber content of turbulent boundary layer pressure fields are presented. An abstract bibliography of current literature in included. For individual titles, see N80-24248 through N80-24249.

N80-24248 Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
RECENT DEVELOPMENT FOR THE NONLINEAR DISTORTION OF NON-DISPERSIVE ACOUSTIC WAVES. PART 2: MULTIDIMENSIONAL SYSTEMS c71
J. H. Ginsberg *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 3-12

refs (For primary document see N80-24247 14-99)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

A perturbation procedure for investigating finite amplitude acoustic waves that depend on more then one spatial coordinate is described. Wave motions that are nondispersive in the linear approximation are emphasized. The results of applying the procedure to a variety of systems are presented. R.E.S.

N80-24249 Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
UPDATE ON THE LOW WAVE NUMBER CONTENT OF TBL PRESSURE FIELDS c34
L. D. Pope *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 8 Aug. 1979 p 15-22 refs (For primary document see N80-24247 14-99)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washinton, D.C. 20375. Annual rate $100.00

Measurements directed at the low wavenumber component of turbulent boundary layer (TBL) pressure fluctuations for the case of low subsonic flow are summarized. Knowledge to predict marine-structure response to TBL pressure fields. R.E.S.

N80-24250 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 10
Judith Nagle-Eshleman, ed. Oct. 1979 89 p refs
(AD-A078374) Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Shock and vibration modes are examined with reference to their effects on various structural elements. The major emphasis is placed on the optimization of dynamic response. An abstract bibliography of current literature is included. For individual titles, see N80-24251 through N80-24253.

N80-24251 Idaho Univ., Moscow.
DYNAMIC MECHANICAL PROPERTIES OF FIBER-REINFORCED COMPOSITE MATERIALS c24
R. F. Gibson and D. G. Wilson *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 3-12 refs (For primary document see N80-24250 14-99)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Efforts to characterize the internal damping and dynamic stiffness of fiber-reinforced composite materials under vibratory loading are reviewed. Several trends are noted, and suggestions are offered regarding directions of future research. R.C.T.

N80-24252 Oklahoma Univ., Norman. School of Aerospace, Mechanical and Nuclear Engineering.
RECENT RESEARCH IN COMPOSITE AND SANDWICH PLATE DYNAMICS c39
C. W. Bert *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 13-23 refs (For primary document see N80-24250 14-99)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Literature concerning dynamics of plate type structural elements of either composite material or sandwich construction is surveyed. Special attention is given to rectangularly orthotropic, cylindrically orthotropic, and anisotropic plates; laminated plates; thick and sandwich plates; and nonlinearities. Free vibration, harmonic and random forced vibration, thermally and flow induced vibration (flutter), and impact are also treated. R.C.T.

N80-24253 State Univ. of New York at Buffalo. Dept. of Mechanical Engineering.
OPTIMIZATION TECHNIQUES FOR SHOCK AND VIBRATION ISOLATOR DEVELOPMENT c39
R. W. Mayne *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 10 Oct. 1979 p 25-33 refs (For primary document see N80-24250 14-99)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Optimization methods with application to shock and vibration isolation are summarized. Included are: nonlinear programming methods that are basic tools for engineering optimization problems of all types, time domain methods of isolator optimization as evolved from optimal control theory; and cases where isolation systems are considered in the frequency domain. R.C.T.

N80-24254 Shock and Vibration Information Center (Defense), Washington, D. C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 11, NO. 12
Judith Nagle-Eshleman, ed. Dec. 1979 151 p refs
(AD-A079549) Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Methods for studying vehicle-guideway interaction problems are reviewed along with methods for structural analysis under dynamic constraints. An annual index of feature articles, literature, reviews, and book reviews, an author index, and a subject index are included. An abstract bibliography of current literature is included. For individual titles, see N80-24255 through N80-24256.

N80-24255 Purdue Univ., Lafayette, Ind. Dept. of Mechanical Engineering.
VEHICLE-GUIDEWAY INTERACTION PROBLEMS c85
J. Genin and E. C. Ting *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 3-10 refs (For primary document see N80-24254 14-99)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington D.C. 20375. Annual rate $100.00

Three general methods for studying vehicle-guideway interaction problems are discussed. These include: moving force approximation; massless guideway approximation; and moving mass approximation. The trolley problem at the Sandia Laboratories is also summarized. J.M.S.

N80-24256 Birla Inst. of Technology and Science, Pilani (India).
A SURVEY OF STRUCTURAL OPTIMIZATION UNDER DYNAMIC CONSTRAINTS c39
M. A. V. Rangacharyulu and G. T. S. Done (City Univ., London) *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 11, No. 12 Dec. 1979 p 15-25 refs (For primary document see N80-24254 14-99)
Avail: NRL code 8404. Shock and Vibration Inform. Center, Washington, D.C. 20375. Annual rate $100.00

Methods used with continous and discrete models are described for free vibration problems. Methods for forced vibration problems and nonconservative problems are also discussed. J.M.S.

N80-24257*# Illinois Univ., Urbana. Aeronomy Lab.
RESEARCH IN AERONOMY Progress Report, 1 Apr. - 30 Sep. 1979
Belva Edwards, ed. 1979 88 p refs
(Grants NGR-14-005-181; NsG-5213; NsG-7506; NSF ATM-76-01773; NSF ATM-78-21765; NSF ATM-78-15224; Grant NSF ATM-78-12308)
(NASA-CR-153189; PR-79-2) Avail: NTIS HC A05/MF A01 CSCL 05B

Several theoretical, experimental, and instrumentational developments in the field of aeronomy are presented. The forcing and propagation characteristics of planetary waves in the troposhere and middle atmosphere are addressed. Instrument payloads and launch objectives are explained for a number of rocket experiments including radio propagation and energetic particle experiments. The development of rocket-borne microprocessors, a lunar aspect sensor, and a rocket-borne energy spectrometer with solid state detectors are also discussed. The use of partial reflection techniques (to study the D region of the ionosphere), a meteor-radar system (to investigate the dynamics of the meteor region), and coherent and incoherent scatter radars (to study ionized regions) are examined. Finally, a laser radar system designed and constructed to measure the latitude distribution of atmospheric sodium in the 80 to 100 km altitude region is discussed. M.G.

N80-24258# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

RETROSPECTIVE STUDY OF SELECTED DOD MATERIALS AND STRUCTURES RESEARCH AND DEVELOPMENT PROGRAMS. PHASE 1: CASE HISTORY DATA COLLECTION Interim Report, Feb. 1978 - Feb. 1979

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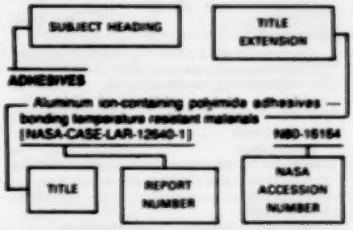
The DOD recognizes a continuing need to examine and, if possible, improve its investment strategy rationale in all of its R and D. Based on a request of USDR and E(R and AT/ET), the Institute for Defense Analyses undertook a study of R and D planning in the limited area of materials and structures. The objective of the study is to determine if the current R and D planning procedures in materials and structures can be improved. This phase I report is an orderly compilation of pertinent case histories. Evaluation and analysis will be the subject of a future Phase II paper. Pertinent studies of the past, such as HINDSIGHT and TRACES, are reviewed along with the IR and D programs of DOD. Funding histories in materials and structures technology are presented. Some outstanding research programs (6.1 category) sponsored by the Navy, Army, and Air Force are traced from their initial concept to their eventual contribution to the technology base. Selected case histories include the Navy's C4 Missile System program, which exemplifies the careful utilization of materials and structures technology advances by the designers. Other case histories discussed include the history and user acceptance of advanced fibers and composites as primary structural components; the development history of titanium and its uses; the Navy's development and sustained utilization of high-yield strength steels; the development of special aluminum alloys for aircraft and ships, and the growth of the graphitic (graphite and carbon-carbon) materials technology and their high temperature applications. The disappointing results of refractory metals for military applications are also discussed. GRA

Typical Subject Index Listing



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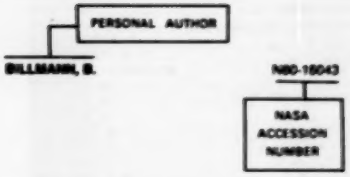

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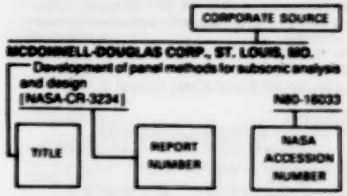

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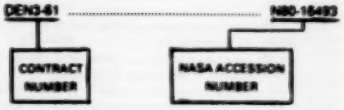

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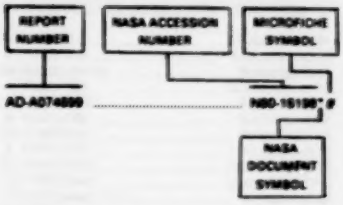

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